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Editorial Note

This is the last edition of *Management Services in Government* in its present form. Just as in the early 1970s our predecessors changed the *O&M Bulletin* into *Management Services in Government* to recognise the broadened scope of its subject matter and the wider audience they hoped to address, we believe that the early 1980s call for another evolutionary change.

Although it was decided that *Management Services in Government,* like the *O&M Bulletin,* should be firmly based in the management services field and addressed primarily to its practitioners, over the years its content has been widened to encompass topics beyond management services and we have tried to attract and interest readers among Civil Service managers generally.

We intend to recognise and continue this trend to a wider content and audience in a successor publication to *Management Services in Government* which will appear in February 1982. To reflect the inward change, we have modified the title to *Management in Government.* Whilst we hope that *Management in Government,* like its predecessors, will be interesting and useful to management services practitioners, we shall be aiming to produce something which will appeal to all civil servants and also be a source of interest and information for a wider audience outside the Civil Service. So we shall continue to inform and keep our readers up to date about developments in the field of management services, personnel management and management generally, both inside and outside the Civil Service, though we do not intend to publish in full technical articles which appeal only to a small number of specialists; we hope their needs will be met by summaries of material which can be obtained elsewhere. But we shall publish also articles about the organisation, functions and activities of government departments, illustrating the diversity, challenge and quality of their work; articles recording the achievements of departments in improving their efficiency and effectiveness; or describing notable achievements. We hope in this way to enable civil servants to inform each other about their work and achievements, and provide the outside world with an interesting window into the Civil Service.

In launching this new venture we hope for the continuing support of present readers of *Management Services in Government.* We are sure that you will gain even more from *Management in Government.*

There will be a wider scope for readers of the new publication to put pen to paper either as correspondents or authors. We shall welcome letters and contributions.

Marks and Spencer and the Civil Service: a Comparison of Culture and Methods

D J Howells, Manpower Services Commission

David Howells is the Assistant Secretary in charge of Manpower and Management Services Division in the Manpower Services Commission, but at the time of writing this article was in the Machinery of Government Division of the Civil Service Department. This article has been published in a recent issue of the *Journal of the Royal Institute of Public Administration – Editor.*

It is a well-worn theme that the Civil Service – and indeed the government as a whole – would gain in efficiency if it was run more on the lines of private enterprise. The more grandiose variations on this theme – the notion of 'Great Britain Limited' – have never carried much credibility, but the work of Sir Derek Rayner has underlined the scope for applying in the public sector certain basic disciplines associated with a successful commercial operation. There nevertheless remains a good deal of scepticism among civil servants about whether the approach of private enterprise is really applicable on a wide scale to the management of public operations. Natural defensiveness aside, this reaction springs in large part from unfamiliarity with life 'on the other side'; after all, the number of people who have worked as senior or middle managers in both the Civil Service and in the private sector is small, and the number who have worked successfully smaller still. Mutual understanding and appreciation is therefore at a premium.

Comparisons between the private sector and the Civil Service (or more strictly, between the marketed and non-marketed sectors of the economy) are usually couched in general terms, and the main points of comparison are familiar enough – measures of effectiveness, patterns of accountability, and incentives to efficient behaviour. There is, however, a lack of more systematic comparisons based on direct experience. This paper is one contribution to filling that gap. It attempts a detailed comparison between the Civil Service and Marks and Spencer in three main respects: decision-taking; systems; management, leadership and motivation. Under each heading the main characteristics of the two organisations are described and an explanation suggested for some of the differences between them.

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Many qualifications are in order. The author's experience in the private sector is limited to a secondment of just under one year to Marks and Spencer in 1979–80; in the Civil Service it extends to the Department of Employment, the central and regional organisations of the Manpower Services Commission, and the Civil Service Department. What follows is not therefore intended to be comprehensive or balanced, but rather a series of observations and reflections which requires to be complemented by the experiences of others. The heads of comparison have been chosen because they illustrate some of the more important and interesting differences of behaviour.

Some features of Marks and Spencer

Most readers will be reasonably familiar with the characteristics and organisation of the Civil Service, but less so with Marks and Spencer. Some lines of description may therefore be helpful as a prelude to analysis. Although it is a large organisation, the structure of Marks and Spencer is so simple and uniform that its main features can be outlined quickly, viz:

- —there are just over 250 stores employing about 40,000 people, full-time and part-time
- —there is a single Head Office in London employing over 3,000 people. It consists of buying departments together with a range of ancillary services—building, transport, accounts, etc. The regional (or Divisional) tier is tiny, and is more a means of communication and quality control than a link in line management
- —systems are strongly centralised and controlled from Baker Street, which determines in detail what stores shall sell and at what price
- —the business is mainly the retailing of textiles, and foods, accounting respectively for about two-thirds and one-third of sales
- —traditionally there has been little movement between the sales floor and management. Managers have been recruited as trainees; after an initial period in stores they either move to Baker Street or progress in store management. Almost no managers are imported from outside
- —although M&S is much less of a family company than it was, the Chairman and Vice-Chairman are still from the founding families, and in many respects the company still bears the stamp of Lord Marks and the first Lord Sieff and of the principles they established.

Decision-taking

Marks and Spencer

Although the style of decision-taking naturally varies with individuals, some generalisations are possible. First and foremost there is a comparative lack of written policy analysis. Debate tends to be conducted orally; policy

papers, such as they are, tend to be short and factual; they point to a particular conclusion rather than highlight choices. The general disinclination to reason things out on paper also extends to an avoidance of many conventional management techniques—eg market research, formal investment appraisal. The net result is that decisions tend to be personalised, informal, contingent on events and *faits accomplis* rather than systematic analysis or regular meetings below board level. Equally important, the volume of paper is small by comparison to the Civil Service and consists largely of progress reports and sales records (which are kept and used manually).

Within their defined spheres of responsibility, people act quickly, decisively and with unquestioned personal authority. Speed of reaction is critical in retailing and the effectiveness of decisions is usually apparent over a short time-scale—a matter of weeks for particular lines of merchandise. Speed of communication is equally important. Thus a telephone cascade system and daily notes (privately delivered to stores) are used for factual messages; changes of mood are also communicated swiftly through the Baker Street grapevine, the Divisional Executives and the numerous visits to stores by Head Office personnel.

The company is not so impressive when it comes to collective decision-taking or dealing with issues that cut across departments. People are much less at home on committees (especially when authority and policy is not clear-cut) than in informal or individual decision-taking. Skills of chairmanship and note-taking are less developed than in Whitehall. Similarly, people are happiest in dealing with the immediate and concrete, especially if it can be related to sales; they are less ready to focus on long-term problems, especially those such as computer development which are not easily resolved by applying traditional company principles.

Finally it should be stressed that senior directors, notably the Chairman, have a marked influence on decisions at all levels. In part this is formal—through Board meetings, departmental reviews and so on. But decisions are just as likely to result from a chance meeting or visit, from a small directional statement or from some event which happens to come to senior attention. Anything in Marks and Spencer is liable to become political at any moment, especially at Baker Street. In this sense a distinction between the strategic and the operational is difficult to maintain—an interesting point of similarity with the affairs of government.

Civil Service

Within the Civil Service there are naturally wide differences in the procedure and style of decision-taking, depending largely on the nature of the activity, the policy content of decisions, the distance from Ministers and so on. But the essential contrasts with Marks and Spencer are still clear enough.

The proceedings and indeed the culture of the Civil Service are centred on the written word. Most issues of note are subject to written exposition, frequently exhaustive, before the point of decision. At its best this approach can mean cogent analysis, a display of options, a clear recommendation and a generally more disciplined treatment of problems than would be likely in oral discussion. At its worst the result can merely be an accumulation of paper and a tendency to mistake careful analysis as a substitute for action.

The actual taking of decisions is too varied and complex to permit easy generalisation, except to say that a far higher proportion of important decisions are reached in a formal setting—eg in a committee or through written submission—than in M&S. Once taken, moreover, decisions are usually recorded in writing and at much greater length. The implications of this for codes and procedures are discussed in the next section.

A further critical contrast is that a higher proportion of decisions in Whitehall are taken by consensus. This applies both to decisions between departments and to decisions within departments which affect more than one interest. Failure to consult gives rise to righteous indignation. One result is the proliferation of committees, with all the associated apparatus of papers, minutes and reports. The committee is therefore an institution with which civil servants are thoroughly familiar and where standards of chairmanship and contribution are generally high by comparison with M&S.

Finally it should be noted that within official decision-making the question of handling and presentation often enjoys high importance in relation to substance—more so than in M&S. Many of the problems which come before Ministers and officials do not admit of solution or even alleviation through governmental action, at least in the short term, so that much thought is given to constructing and defending a policy position which is presentationally optimal in relation to various conflicting pressures. In M&S, by contrast, a higher proportion of issues are capable of being tackled through action by the company (which is not to say that they admit of easy solution!). In Whitehall a shift of policy counts as a decision, and may be the result of great agonising, even when the practical effect is slight or non-existent.

Why the difference?

Most of the reasons for these differences are well-known, but are no less important for that. Firstly, the *issues* considered in Whitehall are more complex and varied than in M&S—more complex in the sense that they bring into play a wide range of legal and political factors as well as straightforward administrative considerations; more varied in the sense that there are not usually a unifying set of principles or techniques which can be applied. As the work of government has expanded, so have the ramifica-

tions and interconnections of policies, and this has reinforced the traditional pressures towards decision-making by committee and consensus reached through written analysis.

Secondly, the *criteria* which govern the decisions are quite different. Within M&S the need to sell goods and earn profits provides a ready standard for most decisions. With centralised control of margins and major costs, the maximising of sales becomes a proxy for performance and profit; the proportion of decisions that are informed by straightforward and measurable commercial considerations is therefore high—possibly higher than in most other companies. Objectives within the Civil Service can rarely be stated so tersely; the nearer to the centre, the more political become the concerns and the more difficult it is to formulate objectives which amount to more than meeting ministers' current wishes. The contrast is not, of course, black and white. There is plenty of internal politics in M&S, just as there are objective and quantifiable tests to be applied in many areas of government, especially in large executive operations. But it remains difficult to find measures of performance in the Civil Service which provide the bite and consistency of sales figures in M&S.

Thirdly, the *structure of responsibility* dictates modes of decision-making. In M&S there is a clear line of authority up to managing director. Below that level people have relatively little cause or inclination to interfere in other people's direct responsibilities. In government the system of collective ministerial responsibility underlies and reinforces the whole superstructure of Whitehall decision-making: the committee system, the clearance of drafts, the copying of correspondence, the ever-increasing volume of comment and counter-comment. The wider the range of interests and departments involved, the more difficult it is to achieve unanimity and the more likely it becomes that the final proposal will be inaction or a compromise far removed from what might be thought efficient in managerial terms.

Fourthly, the *requirements of external accountability* are critically important. The effect on systems is discussed in the next section, but at this point it is convenient to note the unique role of Parliament and its influence on the way problems are approached. This is manifest in a number of ways. In formal terms, of course, Parliamentary sanction is the source of legal authority for most official business and a necessary step in making changes of all sorts. And the day-to-day operation of Parliamentary accountability—eg through Parliamentary Questions or Adjournment Debates—takes up a good deal of official time. But the deeper point, in both constitutional and behavioural terms, is that a Minister owes a duty to Parliament and that his political standing depends significantly on his ability to present and defend his policies there. Thus a key test applied by Ministers to particular policy or presentational options is how they would be

received by Parliament, both by Government supporters and the Opposition—an approach which officials reflect in varying degrees. In this way the relationship between Ministers and Parliament has a long-term and institutionalised effect on attitudes and decision-making which goes beyond the rather uneven impact of Parliamentary business between and within departments. Nor, of course, is it paralleled in private business.

Fifthly, *location* influences both the making of decisions and the way they are communicated. The location of all, or nearly all, Head Office staff in a single building enables M&S executives to talk things over and reach agreements more easily and informally than in a Civil Service environment, where staff are often scattered widely even within individual departments. No one in Baker Street is more than a couple of minutes from anyone else—a vital facilitating factor. Equally, the design and allocation of offices is informed by an understanding of how location influences behaviour; thus the co-location of commercial and technical staff helps to minimise the problem of parallel hierarchies.

Systems

Marks and Spencer

Systems in M&S show two main characteristics: centralised control and simplicity. These features together contribute greatly to the efficiency for which the company is famed.

First, *centralisation.* The company makes no apology for systems which are centralised and which therefore leave little scope for local variation. The argument runs that in a company structured on uniform lines the experience of years has shown the most efficient method and procedure for store operations; provided that the company remains open to new ideas, it is felt that the benefits of sticking universally to best practice outweigh the rigidities of centralised control. The individual store manager, who may be responsible for several hundred people in the largest units, therefore enjoys little scope to vary established procedures; in the same way price, the mix of merchandise and other key variables are controlled from the centre. The manager's basic responsibilities are to maximise sales within these parameters, to minimise waste and locally controllable costs, and in other respects to apply company policy. This comparatively restricted role for the local manager is fundamental; those who do not like it either leave the company or at least leave store management.

Simplicity is the other side of the coin. The company makes huge efforts to ensure that things are kept simple and to cut out the natural tendency of all systems to become more complex through individual bright ideas or as a result of innovations which outlive their usefulness. The approach rests on the systematic applications of well-known O&M principles—standardising forms, trusting people, avoiding procedures that centre on the exceptional

case, and asking questions not just on design but on the basic need for a form or operation. The key to success is that those who strive to keep things simple are working with the grain of the organisation, and that Parkinsonian forces are kept in check by intervention from the top.

There is constant stress on the need to probe, question and generally to keep the eyes and ears open—nostrums which sound trite when stated thus but which undoubtedly influence behaviour for the better.

To the civil servant it is striking that such uniformity can be maintained without any form of codified instructions. The fact remains, however, that the company long ago threw away its codes and now relies on staff to learn and remember the right way to do things. One factor here is that the systems are sufficiently simple that they *can* be remembered, not just by front-line staff but at much more senior levels. Thus the Vice-Chairman can go into a store and discuss the fine details of office procedure with an Office Manager. This aspect of M&S is possibly unique in a company of its size.

The smooth working of company systems does not depend on any very high degree of technological sophistication. Indeed the company is conservative in its approach to office equipment and computerisation, certainly by comparison with other leading multiples. The distribution system is only partly computerised and there is no commitment to point-of-sale data capture and similar developments. This results in part from the very high level of efficiency to which manual systems have been brought—so much so that it does not pay M&S so clearly to switch to new and expensive automated systems as may be the case with less efficient competitors.

Civil Service

Like M&S, the Civil Service has a large number of local units—in not one but many different networks. The following discussion refers primarily to systems within large local office networks serving the public, eg those within the DHSS and the DE Group.

Civil Service systems also tend to be centralised, but for different reasons than in M&S. Typically, an office is collecting a tax, delivering a benefit or providing a service of some sort (eg advice to the unemployed on jobs). Whether or not the activity is regulated closely by law, the procedures tend to be laid down in some detail, frequently in codes which are issued from Head Office and which attempt to prescribe action for a host of different circumstances. There is of course some variation in the comprehensiveness of the code and thus in the discretion enjoyed by regional and local offices; this depends, for example, on the nature of the service or benefit, the outlook of the department and the extent to which local staff are prepared to go their own way.

If the fact of centralisation is a point of similarity with M&S, the obvious contrast lies in the complexity of official procedures and instructions. This is

too familiar a point to labour. Max Weber long ago noted the tendency of officials to prescribe rules and to proceed according to orderly and legally-related rules of behaviour: equity of treatment, a fundamental norm for officials and politicians, leads to uniformity when applied to diversity of circumstances, this in turn produces an elaborate superstructure of rules and case-law. As each fresh anomaly is picked up, or some refinement made to conciliate a particular lobby, the system grows a little more complex.

The pressures making for complexity are well-known. The important point, however, is that they are not balanced as in M&S by a conscious and determined internal pressure for simplification, especially where this would involve an element of rough justice, however small. Although much pioneering O&M work has been carried out within government, the tendency in recent years has been for systems to be badly maintained and to get out of control. Important symptoms here are the further multiplication of forms and instructions; the inhibitions on procedural change arising from trade union opposition; the tendency of local offices to develop their own systems as the official system becomes out of date and inapplicable; and the ever-decreasing number of people who may have a full understanding of how a total system is supposed to work. This last is a particularly worrying development.

How many people can claim a comprehensive understanding of, say, DHSS local office procedures, as opposed to the particular procedures which may be the concern of individual policy branches? And do the cognoscenti include the senior officials whose task it is to ensure the integrated and efficient delivery of services? Officers above the rank of, say, Principal are not accustomed by inclination, training, career experience or by job pressure to interest themselves in the detail of local office systems or to put themselves in the shoes of staff whose task it is to operate them. The traditional distinction between policy and operations—a distinction which M&S would greet with suspicion—both expresses and reinforces the lack of concern and expertise among senior staff with detailed systems work.

Why the difference?

Some of the main reasons for the marked difference in approach have already been suggested, but they bear systematic restatement. First and foremost there are the requirements of *accountability*. In a legal sense Marks and Spencer, as a limited company, is accountable only to its shareholders and not to outside authority. That does not, of course, imply indifference to outside opinion, whether among its customers or in a wider public relations sense; indeed the company makes great effort in this direction, mostly for good commercial reasons, and runs a sizeable customer service unit. But at the end of the day the company does not need

to engage in elaborate justifications of its policies; it simply makes and implements them. It is under no obligation to run a line or provide a facility—eg toilets or changing rooms—unless it considers it commercially right to do so. As a result people at all levels in the company are free to concentrate on maximising the internal effectiveness of the business, and this is the criterion by which they are judged. There is no need to maintain records or systems against the possibility that this or that policy or action may need to be justified at length to the outside world.

By contrast the Civil Service deals with the outside world in many modes—as claimant, supplier, lobbyist, politician and as customer. That is not to say that all departments or civil servants have to handle all these different types of relationship. But it remains true that the requirement to justify official actions has traditionally exerted a deep influence on the approach of civil servants and on the records which they judge it necessary to keep. No civil servant wants to expose the Minister (and therefore himself) to criticism, and this leads him to play it safe in terms both of decision-taking procedures and systems within government departments.

This is not to say that the traditional approach is necessarily 'justified', or cannot be adjusted by Ministers and senior officials. But those making the adjustment must understand why the requirements of accountability naturally lead civil servants to develop systems which are over-complex according to conventional administrative criteria. Finding a practical incentive for simplicity is the key, although this is easier said than done.

Secondly, the *differing nature of the basic activities* has implications for systems. The two basic activities of M&S are the procurement and sale of goods, and the latter accounts for the great bulk of transactions which need to be recorded. The act of sale admits of simple and unbureaucratic record-keeping, at least in the way M&S approaches it; there is no decision or judgement to write down—just a ring on the register and subsequent tallying between stock delivered, some sales recorded, and money received. Although some of the dealings of civil servants can also be recorded similarly, this is not generally so. Indeed the activities in which government has become engaged tend increasingly to involve case-work of some sort. This applies, for example, to discretionary benefits (eg supplementary benefit); to the administration of grant schemes based on broadly drafted and judgemental criteria; and to applications for services such as a government-sponsored training course, where a subjective judgement of capability is required. In all these cases it is necessary to make a judgement, and then to communicate, implement and record it. The administrative systems required to underpin these activities may be made more or less simple, but the starting point is one of greater complexity than in M&S.

Thirdly, the *requirement to administer complex systems uniformly* is a

major factor. Uniformity itself is not an explanation. M&S systems and services are outstandingly uniform across the country; but they are uniformly simple, and can thus be remembered by staff, provided they are properly trained and stay long enough with the company. There are several reasons why this would be difficult to achieve in government offices: the legally-based nature of many payments, the application of a simple basic concept to the innumerable different circumstances of individuals, high levels of staff turnover, and above all the tendency for schemes to become more complicated as a result of concessions to pressure or the needs of particular groups. All this results in the voluminous codes which are a familiar feature of local offices. A vicious circle applies here. Because the system is written down in a code, it is a relatively simple matter to add further variants, and to assume that the task of communication has been completed once the amendment has been issued (an assumption that is ever more facile with the diminishing reservoir of experience in local offices). An important factor here is the *London-bound* and *desk-bound* nature of work in the Head Offices of Departments, which is discussed in the next section.

A final point to note is the influence of *trade unions* in the Civil Service. M&S is a non-union company and determinedly so. Although a good deal of thought is given to the impact on staff of changes in store procedures, such changes once decided can normally be implemented without fear of structured reaction from staff or unions. Pay and manning levels are determined unilaterally. All this may be highly enviable to the manager in a trade union environment, although it should be said that this state of affairs only exists because of the immense efforts which are put into leadership, communication and staff welfare. Levels of trade union organisation in the Civil Service have, by contrast, been high for a long time, but in recent years the unions have become more militant and have also extended the issues which are subject to collective bargaining, notably in matters of procedure and systems. The extent of this varies with departments, as does the vigour and confidence of the official response. 'Systems changes' are far from impossible, but they are undoubtedly more difficult to achieve than used to be the case, and the prospect of a further round of tiring and burdensome negotiations acts as an inhibiting factor on line management.

Management, Leadership and Motivation

Marks and Spencer

The life of a manager in M&S is typically very different from that in the Civil Service. All managerial recruits start off in a store—an important common experience. After three to five years about half then transfer to Head Office, normally to train in a buying department. But jobs in Head Office are not nearly as office-bound as in the Civil Service. Managers spend a lot of their

time away from the desk, mostly visiting suppliers and stores. In particular, it is thought essential that managers take every opportunity to see and probe for themselves what is happening in stores, not only to improve decisions but also to minimise the inevitable gap between Head Office and field staff that arises in all large organisations. From time to time all executives are sent out to stores for a couple of weeks, in order to ensure that they do not get out of touch. In addition every store is visited at least once a year by a Director and other staff from Baker Street.

When in the office, the manager in Baker Street will not generally be confronted by large piles of paper. He will naturally have letters and sometimes reports to write, but they are not too frequent or lengthy; partly as a result, report-writing skills are generally lower than in Whitehall. By and large he will spend a good deal of time on the phone, in dealings with suppliers and contractors, in reacting to sales trends, in internal meetings, and in assessing new and proposed merchandise. He will probably spend less time in solo considerative work than the civil servant and will almost certainly take less paper home.

The store manager's life is naturally different. His essential tasks are to look after the goods, the customers and the staff—which he does mainly by spending the maximum time out of his office and on the sales floor. For purposes of comparison with the Civil Service, the major points of interest are the almost complete absence of written and considerative work, the need for a close grip on what happens at the sharp end in terms of sales, and above all the stress placed on the motivational aspects of his job.

M&S places great importance on the motivation of staff and the skills needed to achieve it. The company wants staff to identify with M&S, to understand its aims and to feel part of an organisation which does worthwhile things. In this it has succeeded to an impressive degree; the outsider cannot fail to be struck by the strong and sometimes fierce loyalty shown by staff at all levels, and the feeling that they work for an organisation which is both efficient and socially useful.

In order to maintain these attitudes the company looks for leadership as a necessary quality in its managers. Of course other skills are needed too—quick and effective speech, speed of reaction and commercial judgement—but without the ability to lead, motivate and enthuse the trainee will not progress very far. Although leadership styles differ with personalities, the norm is a fairly traditional one—visible, assertive, sharp (with an edge of humour) and demanding of high standards and effort. This is complemented by the company's well-known attention to 'hygiene factors'—staff facilities, health care, hairdressing and meals at a nominal charge, and a sympathetic approach to personal difficulties—backed by a heavy investment in staff management. In every store there is a staff manager whose business it is to attend to legitimate worries—and also to take a tough line

against slackness and malingering. The whole package might be thought paternalistic, but it works.

The Civil Service

Generalising about civil service management is more difficult. Although a significant proportion of senior managers (but not usually the most senior) have risen from the lower grades, the fast-stream graduate recruit typically starts in Head Office and stays there, not gaining experience in a regional or local office where most civil servants work.

By comparison with M&S, the work of Whitehall is London-bound and desk-bound. Many civil servants dealing with Ministerial and Parliamentary business have little or no occasion to leave London. Even where the job is managerial or where decisions are involved which bear on local administration, there is no institutionalised pressure as in M&S to observe things at first hand. This is reflected in a willingness to work through hierarchies and to rely on paper-based systems of communication which require information to be passed through a number of filters. For this and other reasons there is generally far more paper than in M&S.

There is also a contrast in personal style. In their personal dealings civil servants are usually more gentle, restrained and polite than in M&S; readier to take refuge in the written word, more inclined to shy away from confrontation. They are also more willing to present their masters with uncomfortable facts, to disagree and to commit those disagreements to paper. The atmosphere is generally more tolerant of dissent, and civil servants often go about their business with a professional cynicism that could not be shown in M&S.

By contrast the subject of leadership is little stressed. More emphasis is placed on intelligence, tactical judgement and the ability to perform well on paper. For all the emphasis on managerialism in the Fulton Report and after, most officials see themselves (in many cases correctly) as the confidential advisers of ministers rather than the managers of activities; they look up, not down. Jobs which involve the management of activities therefore command comparatively low prestige, even though they may involve control over very large resources. The reward and promotion system accordingly places relatively low emphasis on qualities of leadership and personality which would be much more critical within M&S, and this in turn helps to account for the rather colourless and remote style of management within the service, especially at the higher levels.

Partly as a consequence of all this, the gap between the centre and the field is far wider in the Civil Service than in M&S, and levels of motivation are lower. Motivation is probably highest near the top and in those further flung parts of the service where the tasks are stable, reasonably rewarded and generally recognised to be necessary. But elsewhere levels of

satisfaction and motivation are much lower, reflecting the changes in composition and outlook which have taken place, especially in Departments with large local office networks. Compared to the pre-war period, or even to the 1950s, today's Civil Service is much younger, less stable and committed, and less motivated by an ethic of public service. Many, if not most, civil servants are not particularly attached to their work or to the Civil Service as a career but see it just as a job, whose attractiveness is set against alternative jobs in different organisations. They neither meet nor identify with senior officials; nor do they share the same outlook or experience. Their modes of compliance are, in the language of sociology, utilitarian rather than normative, and this is an important contrast with M&S.

Why the difference?

It is reasonable enough that behaviour in any organisation should reflect its main activities. M&S is a sales organisation; it must persuade the public to buy—hence the outward-looking and downward-looking approach of its managers, the emphasis on managerial-type behaviour and the premium on speed. In the Civil Service the role of Ministers and Parliament, both in constitutional and in political terms, leads to a different orientation. These functional differences are, however, strongly reinforced by the differences in career pattern and in basic outlook which have been described. In the scope of this paper, it would be difficult to go further as regards attitudes among senior staff; but it is worth exploring some of the reasons for the differing levels of motivation at more junior levels.

Firstly, the *objectives* of M&S are straightforward, worthwhile and easily understood. Incorporated as they are into the social and organisational structure of M&S, they give the company its values and its distinctive identity. People in different parts of the company can see how their work inter-relates and can agree that it benefits M&S, the public and ultimately themselves. By contrast, the Civil Service does not (at least in constitutional terms) embody objectives of its own but is rather the instrument for putting into practice the changing policies of ministers. The values which the civil servant traditionally holds are therefore instrumental in character—neutrality, personal integrity, intellectual rigour—and do not bear primarily on end results. However commendable these values may be, they are scarcely effective motivators in today's conditions. The same is true of the particular policies of government, which are often complex, conflicting and liable to change; they cannot serve as a source of motivation except in certain circumstances—eg where the unit is close to ministers or where it is new and expanding. The aim of keeping the Minister happy and getting the Government's business through—which is frequently the ruling force in the Head Offices of departments—can have little appeal down the line.

The second and very different factor is that *management* in M&S is so

much *more personalised* than in the Civil Service. To some extent this reflects the history of M&S as a family company and the continued presence of family members at the top, but it is reinforced by the activist style of work and by the conscious efforts to keep the centre in touch with the periphery. This is not just public relations. It is seen as functionally necessary for managers at all levels to know what it going on by seeing it for themselves. An important effect is that the leading personalities of the business are well-known in stores through their visits, and that staff respond to this interest. Thus the commercial requirements of the business tend to promote a style of management which helps to motivate staff. In addition the social skills associated with selling can readily be turned to leading and motivating staff—much more so than the civil servant's traditional skills.

Thirdly, one can point to a *decline in the traditional ethic of public service.* Max Weber is again relevant. After categorising the different forms of authority into three main types—traditional, charismatic and rational-legal—he suggested that a key characteristic of bureaucratic organisations was acceptance of rational-legal norms, as indicated by a willingness to accept the authority of officeholders and to act in accordance with officially sanctioned codes of behaviour. This was the sociological underpinning for the constitutional role of the civil servant, at least as traditionally conceived. And at one time it may have been true that rational-legal values of this sort were widely accepted by civil servants. But is this still the case? Most civil servants are not now content merely to be used as instruments. Nor do they identify with or always obey their senior officers. Their loyalties and energies are not given automatically but need to be won and engaged, in a way that requires a more charismatic, motivational kind of leadership. At the same time the traditional unifying concept of public service is far weaker, not surprisingly at a time when the man in the street does not accept that the best way to serve the public is to be a public servant. M&S is not immune from changes of this sort, notably a disposition of people to question in a way that would once have been unusual; but the company's style of management and the well-established patterns of motivation and loyalty mean that it is far better placed to respond to these wider shifts of attitude.

Finally, there is an obvious *organisational contrast.* M&S is a unitary organisation, easy to describe and understand. The Civil Service is a federation of departments, and of units within departments which are often semi-autonomous in terms of career progression and identity. It is therefore possible to build up a sense of commitment to M&S as a whole in a way that is far more difficult in the Civil Service. Sheer size is a factor here as well as organisational structure. The problem for government is that the development of loyalty within smaller and more human units cuts across

the attempt to make government operations as a whole more coherent when this involves the sacrifice of a part for the good of the whole. Unlike M&S the tension therefore exists between perspective and effectiveness on the one hand and the realities of group behaviour on the other.

Concluding thoughts

This paper has taken three important aspects of managerial performance, described the contrasts between M&S and the Civil Service, and attempted to relate them to the institutional and cultural background. But description and analysis is one thing; drawing conclusions for action is another.

The main question arising from this account is how far these evident differences are attributable to factors which are enduring and necessary, notably the relationship of Ministers to Parliament, the obligation on a public service to provide equitable treatment, and the tension between political and managerial objectives. Conversely, how far are the differences caused by attitudes and practices which, however hallowed by tradition, are susceptible to change? And how far is it desirable to try to change them? In other words, how much could and should the Civil Service learn from M&S, at least in general terms?

Firstly, there is a lot more to be learned than many civil servants are ready to concede. To say this is not to deny that M&S could also learn something from the best civil service practice. Nor is it to suggest that business values and practices offer a ready-made solution to the wider problems of government. But the relevance of business experience is too easily shrugged off by references to constitutional limitations on a civil servant's freedom of action, perhaps coupled with a hint about the mixed record of businessmen in politics and government.

Secondly, the way where civil servants could benefit most from M&S practice is in behavioural terms, especially the following: a disposition to probe; an insistence on seeing things directly and a consequent distrust of bureaucratic filters; a willingness to get away from the desk and thus a refusal to define work according to the in-tray; an intolerance for paper; a recognition of the danger of remoteness from staff and of the importance of personality and belief for effective communication. Put thus broadly, these features might seem commonplace, even banal, but no one who has seen the two organisations could underestimate their importance or the scope for applying them more widely in the Civil Service.

Thirdly, the difficulties of bringing about a shift of attitudes on these lines have less to do with institutional or administrative factors than with finding incentives for efficient behaviour. In a sense no one should need to be pushed into efficiency, but to say this is to ignore the environment in which attitudes are formed. In M&S the atmosphere is such that someone who behaves as described above is working with the grain of the organisation.

Not so in the Civil Service, where pressures push in the opposite direction. Naturally there are many examples of successful and innovative management in departments, but they depend unduly on highly motivated individuals who behave in ways not normally associated with civil servants. The system does not produce individuals like this as a matter of course; nor does it ensure that people in the second rank, on whom so much depends, behave similarly. On the contrary, there is everything to be gained by keeping up with the paperwork and by avoiding risk. And the strength of trade unionism within the public service makes the management of systems change a formidable task of consultation, negotiation and occasional confrontation. Greater incentives are needed for individual managers to counterbalance the forces of inertia and caution.

Finally, it must be conceded that M&S practice is much less relevant in the field of policy advice to ministers and in handling those areas of work, concentrated in Whitehall, which are of close concern to Parliament. In one sense this does not matter greatly since the numbers of staff involved, although large in absolute terms, form only a small part of the whole civil service. But in another sense the attitudes to be found in the Head Offices of departments are important because they set the tone of the Civil Service and determine its measures of prestige. Moreover, decisions taken at that level affect what happens down the line. At the very centre the main call will continue to be for generalist policy skills and above all for sheer good judgement. But it is also essential to recognise and develop the very different type of executive skills required to manage major structures in the public sector. More than a decade after Fulton, the right balance has yet to be struck between these two critical needs.

Results of Stand-Alone Word Processor Trials

F H C Wyatt, Civil Service Department

Frank Wyatt is a Senior Executive Officer in the Office Technology Division of the Central Computer and Telecommunications Agency and was a member of the team which produced the report of trials of stand-alone word processors in UK Government typing pools 1979/80* – *Editor.*

Since my colleague Eric Baldwin-Smith's article in the May 1980 edition of *Management Services in Government,* the report of the trials has been published.* It has received more or less favourable notices from a wide cross-section of the press—national and technical—and comments range from 'one of the best available reports on the productivity of word processors' *(The Financial Times)* to 'the CCTA did some tests . . . which concluded that word processors are not highly productive—but are fun' *(Computing).* The latter report, although appearing on the back page of the newspaper in question, goes on to emphasise the important point brought out in the quotation that job satisfaction does rise noticeably and workers are generally happier. As time goes by and we are gaining more experience in the use of word processors—and their baby brothers, the electronic typewriters—we are becoming increasingly aware that what might be termed the human aspects considerations which directly affect the job satisfaction and performance of those using them, are one of the most important factors contributing towards the successful introduction and use of word processors. Another important factor—perhaps *the* most important factor—is training. More of this below.

The report

Over 3,000 copies of the 80-page report, in its distinctive green cover, have already been distributed, some as far afield as Australia, Israel, Canada, Switzerland, Hong Kong, Saudi Arabia, New Zealand, Singapore and, the home of the word processor, the United States.

As explained in the previous article, the equipment used in the trials was

*Stand-Alone word processors: Report of Trials in UK Government Typing Pools 1979/80; 1980; 34pp plus appendices; ISBN 0 7115 0028 2; gratis from Central Management Library, Civil Service Department, Old Admiralty Building, London SW1A 2AZ.

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chosen to be representative of the types and price ranges currently on market at the time the trials started. The prices ranged from £6,000 to £9,000 for each stand-alone system and displays varied from the one line 'thin window' to full A4 page size. The objective of the trial was to evaluate the effect on typing productivity of using these machines in a normal civil service typing pool and on the usual type of work found in such pools and, in doing so, to get a quantified view on whether WP equipment could be regarded as cost-effective for this use. To do this, comparison was made between the performance of typists both as individuals and as groups on a 'before and after' basis: on electric typewriters and then on word processors.

Findings of the trials

The main conclusions of the report are set down in the Appendix to this article. The following extract indicates the ideal environment for word processors. This would appear to be one where:

- the organisational atmosphere and environment are conducive to the introduction of new typing systems concepts and to the use of equipment based on new technology
- a high proportion of the work consists of long revision typing (eg multi-draft reports) or of standard text (standard letters, paragraphs, etc) or requires the quality of finish associated with WPs
- the WP operators have been carefully selected
- the operators have been well trained and the authors sufficiently well informed to take full advantage of the features and facilities offered on the WP equipment
- the work and staff are well organised and managed.

The conclusion which surprised many of our readers, especially those in the private sector, was the fact that the increase in productivity to be gained through the introduction of word processors is shown to be nowhere as great as had been generally believed. Although some of our operators on the most suitable work achieved individual gains in excess of 100 per cent, it became clear that the increase of 200 or 300 per cent claimed by WP enthusiasts must apply only to work consisting almost exclusively of standard paragraphs, a type not encountered during our trials. This leads one to wonder about the efficiency with which such work has previously been done. We in the Civil Service like to pat ourselves on the back and say that the general level of productivity of our typists is higher than that of the average 'secretary' in the great outside world. Maybe this is because we retain the concept of the typing pool presided over by a supervisor and because we pay continuous attention to the way we organise our typing resources. My aforementioned colleague, Eric

Baldwin-Smith, wrote a relevant article entitled 'A Good Housekeeping Exercise in Typing and Secretarial Services' for the November 1979 edition of *Management Services in Government*. It is of interest in this context that some companies in the USA are reported to be going back to the typing pool concept.

Anyway, we must bear in mind that these trials were intended to be conducted on the normal range of everyday typing work that finds its way to the pool. The lesson to be learned is that the careful selection of suitable typing work and staff can result in the most dramatic increases in productivity resulting from introduction of word processors. When work contains large amounts of pre-recorded text, such as long reports going through numerous revision phases and documents put together from standard pre-recorded paragraphs, significant increases in productivity can result. The most proficient WP operators in the trials achieved gains of 50 per cent on a mixture of standard text and long report work. But the results of the trials have not indicated any such dramatic increases in typing productivity for the full range of work as found in civil service typing pools. In particular our trials proved that it very often took longer to prepare short letters, memos, etc, on a WP than on a typewriter. The only advantage for this type of work was where the superior quality of a daisy wheel printer was of paramount importance. But this again draws attention to one of the pitfalls of introducing WPs which should be avoided through well planned user education: the use of a WP-prepared correspondence simply for prestige purposes. (There are of course nowadays devices known as electronic typewriters which are perhaps more appropriate for use by personal secretaries and which will give the same print quality at half the price of a WP.)

So much for the selection of the right work for WPs. How do we go about selecting the right operator? Members of the trial team, which included a statistician and behavioural scientist, spent a lot of time looking at the results and data to try to find some clue about what qualities to look for which would indicate potential to become a very good word processor operator. And since the length of the learning curve is very significant when it comes to evaluating the cost effectiveness of the operation, which typists would become good word processor operators in the shortest possible time? Alas, no formula appeared as if by magic. The best indication we were able to get was that a speedy and accurate performance on amendment typing, ie working from a draft with lots of deletions, insertions, balloons, etc, when using an electric typewriter was a good sign that the person was likely to become a proficient WP operator. The WP operators tended to work out their own style and technique for operating the WPs. That is not to say that they adopted their own procedures for doing particular jobs: that cannot be allowed as it is essential to the good management of a WP installation that operating procedures are rigidly

adhered to so that one operator's job can be readily amended by another. But some typists found that since conscious errors were comparatively easy to correct on the WP they relaxed a little on accuracy. We have to be very careful here that the apparent increase in speed thus gained is not purely an illusion; where we are achieving only marginal increases in productivity through the use of WPs, then anything which detracts from that increase is to be deprecated. Every error needing to be corrected takes an amount of time.

Similarly, the functional design of the WP keyboard and, indirectly, the software under which the machine operates, is of vital importance to overall efficiency. Some WPs can still be found on the market which require two, three or even more key depressions to initiate even the most common functions. Some have a row of function keys, very tidily arranged, but bearing equivocal, misleading or abbreviated descriptions on their tops. WP operators like to be able to touch type the function keys as well as the letter keys and arrangement in groups generally facilitates this. A whole long list can be made of points like this which come under the heading of human factors considerations. The main thing to try to achieve is a good match between machine and application and ensure the operator can use the machine effectively.

This conveniently brings in the question of ergonomics in the work place and gives me the opportunity to make a plea on behalf of our typists, secretaries and WP operators for a well designed, comfortable chair to sit on. After the WP itself, which may cost up to £10,000, the second most important item of equipment for its operator is the chair that goes in front of it. Poor seating can lead to bad posture which can result in an inferior typing performance and give rise to all sorts of apparently unrelated ailments and complaints such as headaches, eye strain and aching arms.

Adverting to the human factors considerations, this is where a fundamental difference lies in the attitude of equipment designers, management and everyone else towards the operator of a WP as opposed to an ADP terminal: he or she is not expected to have to adapt physically or mentally to fit the equipment; the equipment should be designed first and foremost to be operated by a normal, average human being. If such a person cannot learn to operate it in a few days, there is probably something wrong with the equipment's design. Perhaps my colleagues on the ADP side of CCTA will forgive me—coming as I do from a poor, deprived, management services background—if I say that programmers and other users of computers, both mainframe and micros, really have made life more difficult for themselves by tolerating VDUs with elongated or generally badly designed characters on them, using a keyboard consisting of an anarchic mixture of function and letter keys and taking a masochistic delight in memorising inexactly described or esoterically labelled function keys. The

WP operator is there to operate the WP and ease of use should be the prime consideration. The marginal increases in productivity mentioned above can be whittled away at an alarming rate by long-winded procedures, redundant keystrokes and would-be helpful features likes menus or prompts appearing on the screen which cannot be by-passed for speed by the experienced operator. Features of operation which at first appear a little bit silly can become downright annoying and can cause an operator to lose sympathy with the equipment resulting eventually in loss of productivity.

The Way Ahead

Although, so far as stand-alone word processors are concerned, the report came to certain conclusions, it also serves to open the door on to a whole new world of devices and systems and different uses of WPs not covered by the trials. Some of these were outlined in the CCTA book'et *'New Office Technology in the Civil Service'**. An important trial associated with word processors is that which has taken place over the last six months or so into the use of 'Electronic Typewriters' in various typing pools in the Civil Service. The trial has been conducted along similar lines to the stand-alone WP trials although scaled down in number of machines and time-scale. We wanted to get an idea of which of the several levels of price and complexity of machine would be most cost-effective for general civil service use and also what sort of work the various types of machine would best be employed upon. The trial has been finished and will be reported upon fully.

Agreement with the CPSA

The most important development since completion of the stand-alone word processor trials was the agreement reached on 6 May 1981 between CSD and CPSA providing for the co-operation of CPSA in the introduction and use of stand-alone word processors for typing in government. The various factors identified in the report as needing to be taken into account in the appropriate use of the machines were used as the basis of the discussions with the CPSA and are reflected in the details of the agreement. These main areas are consultation arrangements with the unions; job design and staff involvement; supervision; grading, allowances and complementing; selection of operators; training; effect on jobs; environmental aspects; and work measurement. Although the scope of this agreement is confined to the use of stand-alone word processors for typing, it is nevertheless of great value in enabling the Civil Service to move ahead and get the benefits of word processing, at the same time giving management and staff the

*_New Office Technology in the Civil Service_ by R F Goodman, A E Smith and E Conn; 1980; 16pp; gratis from the Central Management Library, Civil Service Department, Old Admiralty Building, Whitehall, London SW1A 2AZ.

experience of using the kind of new device that is an important base for office technology generally.

The agreement could be said to be something of an achievement in staff relations given the present climate and opposition to new technology. But there may be an important lesson to be learned from the way the union interests were handled here. The national officers of the Civil and Public Services Association (the trade union for typing grades in the Civil Service) were involved in the WP trials right from the start through a liaison committee which met regularly throughout the course of the trials. We cannot pretend that there were no problems along the way, but whatever the problems or difficulties at a particular time, we always managed to find a way forward. But the close liaison obviously helped. It also ensured the union officers and representatives were fully acquainted with the results of the trials. The negotiations following the trials were therefore based on a realistic understanding by both sides of the important matters which were to be discussed.

Conclusions

It has not been possible, within the confines of this article, to offer more than a commentary on the trials and to include some of my own thoughts and opinions, some of which have been developed since the trials finished. Our next task is to find out from the trials departments what progress has been made since the trials ended. This is important because a trial is necessarily somewhat artificial in some respects; and the WP pools in question will no doubt have been anxious to take advantage of the lessons learned and problems encountered during the trial period. Nearly everyone who becomes involved with WPs becomes enthusiastic and keen to make full use of them by learning new ways in which they may be employed to help the day to day business. There is enough evidence around now to give any potential user a very good idea of the potential of word processing, its advantages and pitfalls. Most departments are currently reviewing their future WP needs and discussing with their trade union sides the departmental arrangements that will be necessary in the light of the WP trials and agreement.

APPENDIX

Summary of conclusions

- The use of word processors (of the type used in the trials) in UK government typing pools will be justified, in cost terms, if increases in typing productivity of between 43 per cent and 72 per cent are achieved (based upon salary and other costs current at the time of the trials).

- Mean productivity improvements of this order were not generally achieved on the day to day work by the majority of operators during the trials.
- Not surprisingly the main areas of increased productivity that were identified were those involving a substantial element of repetition of previously recorded material, but not all typists achieved high productivity increases using WPs on this type of work.
- However, the careful selection of typing work and staff can have a very beneficial effect on WP productivity. Gains of 50 per cent were achieved on a mixture of standard text and long report work by the five most proficient WP operators on the stand-alone trials and individual gains in excess of 100 per cent were achieved in certain departments on long report and standard text work.
- There were clear indications that some standard text work offers considerable potential for productivity gains: the five best WP operators showed increases of over 90 per cent and at the location with an existing library of this type of work WP output rates in excess of 16 Treasury Typing Units (TTUs) (about 350 lines) per hour were recorded compared with the overall mean output on electric typewriters (ETs) of 4·16 TTUs per hour.
- The best pointer to likely operator success on WPs that it has been possible to identify is good electric typewriter performance on amendment typing.
- The results of the trials have *not* indicated any dramatic increases overall in typing productivity when using word processors for the generality of typing work. It must be concluded that, in terms of strictly quantifiable benefits to set against costs, there is no general cost justification for the use of WPs for the *full range* of work found in civil service typing pools.
- No advantage was found overall for one-off initial copy typing such as minutes, letters, memos, etc, except where WP quality was required. It can be concluded from this that it is more cost effective to use ETs for initial typing, especially for shorter work.
- The overall conclusions therefore on typing productivity are that careful selection of work and operators are of paramount importance. If WP operators are carefully selected and properly trained, WPs can be justified for multi-draft textual and tabulation material (eg reports, handbooks, instruction manuals, tabulations) and for standard text work. Also some benefits, which will contribute towards the overall efficiency of the organisation, although difficult to quantify in monetary terms, are nevertheless identifiable, eg superior print quality and layout, increased job satisfaction on WP operation, enhanced facilities

and systems possibilities, and it is reasonable to expect the build-up of cost effective applications once a WP installation has been established.

- The majority of typists, although generally satisfied with the quality of the training, felt that the length of training was insufficient and that there was a tendency to cram too much into a few days.
- Supervisors need to be fully trained in the uses of the equipment in order to guide and advise the operators on its best use, maintain credibility with their staff, understand the systems and organisational requirements and liaise effectively with authors.
- Experience on the trials indicated that the way in which WPs are introduced and managed can significantly affect their successful use. A firm and positive management style, but one which nonetheless encourages a team spirit, is particularly effective.
- With the advent of WPs and their use on the production of long multi-draft textual material, or of items compiled from standard text, more attention during planning, introducing and managing the system needs to be focused on the total system from origination to final production. Both authors and typing staff need to combine effectively in their use of the facilities available to them.
- The existence of WPs in a department affords management the opportunity of developing to a considerable extent the use of standard text for certain work. Departments introducing or using WPs should consider ways in which standard text can be used to greater effect.
- A high percentage of typists found WPs satisfactory and wanted to continue using them. Only 7 per cent said they would not want to.
- At the end of the trials only 15 typists asked for the follow-up examination (eye tests) and no significant difference was found in their visual acuity. These results are in line with those recorded by Medical Advisory Service from eye tests they have carried out on about 1,500 civil servants. The Medical Advisory Service have found no medical evidence of any hazard to eyesight through the use of Visual Display Units (VDUs).
- In planning the introduction of WPs, departments should consider carefully the environmental and ergonomic conditions.

Assessing the Effects of New UK Coins

Dr C Maddock and Dr H Morgan

Hugh Morgan is Assistant Director (Planning) at the Royal Mint; Chris Maddock was on loan from the Ministry of Defence to CSD's Operational Research Division. Both are Principal Scientific Officers. In the article that follows they express some personal views — *Editor.*

The Royal Mint at Llantrisant is one of the largest in the world. Over 50 per cent of the coins it mints are exported, and it also produces the 1,000 million or so coins required each year in the UK. Since decimalisation in 1971 the Mint has kept possible developments to the UK coinage under careful review. This is not only because of its responsibility to the public but also for the five-year Corporate Plan it prepares as a government Trading Fund. In late 1979 the Mint was particularly concerned with the possible need to replace the £1 note by a £1 coin and also the possible need for an intermediate coin of 20/25 pence. To clarify the effects of these developments and the costs to the Exchequer the Operational Research (OR) Division in CSD were asked to carry out a study. A recent paper in MSIG* has described some of the applications of OR in government and the analytical approach it uses. Part of this is to identify systems and then assess scientifically the effect of changes to them in an objective comparable way. The starting point for this study was an appreciation of the system of circulating and distributing cash in the UK and of the structure of its currency.

The currency system and structure

In a sophisticated economy the coins and banknotes which make up the cash in circulation are provided by government as a service to the individual. High value transactions by individuals and financial transactions by the corporations and bureaucracies are made through the banking system. Cash is used by individual citizens in everyday life. In fact the value of the cash in circulation is less than one-fifth of Sterling M3, the usual measure of the supply of money in the economy. The government aims to provide this

*The Application of OR in government, T P Turner, *Management Services in Government* 1981, February, pp 29–37.

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service as economically and efficiently as possible making use of the Cash Distribution System (*Fig 1*). It uses as its agents the *Royal Mint* to provide the coinage and the *Bank of England* (and to a lesser extent the Scottish Banks) to provide the note issues. These two authorities arrange for the distribution of cash to the *Clearing Banks.* Through their seven branches and Head Office the Bank of England collect notes unfit for re-issue and undertake their destruction and replacement. The Royal Mint supplies coin to order by the Clearing Banks, but has no obligation to take back coin and this is done only in special circumstances. Delivery by the Mint to the Clearing Banks are to their Cash Centres rather than branches. The London and Scottish Clearing Banks undertake the main cash circulation task. There are about 100 Cash Centres serving the 14,000 branches, delivering and collecting coin and note to meet the pattern of demand. Most businesses and *Other Financial Intermediaries* (such as the PO, TSBs and Building Societies) draw their cash requirements from the Clearing Banks. The UK is

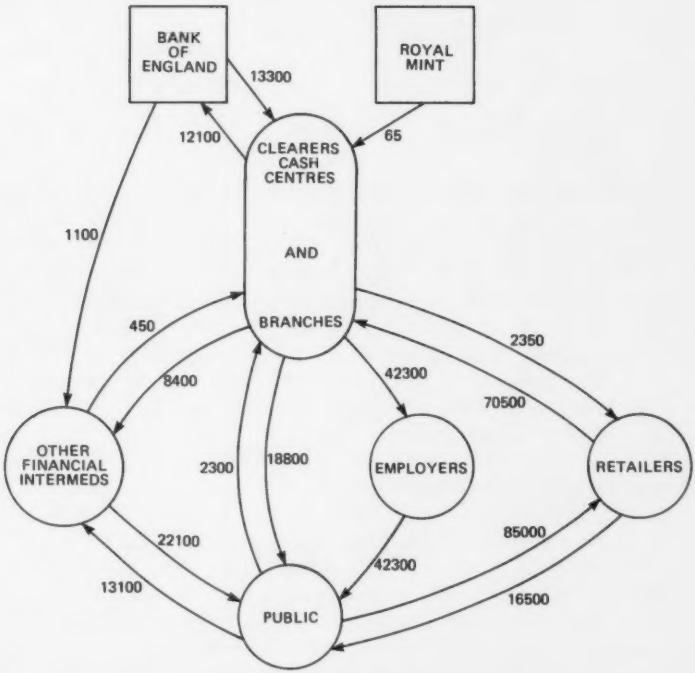


Figure 1 The main components of the cash distribution system, estimated 1979 flows £Mpa

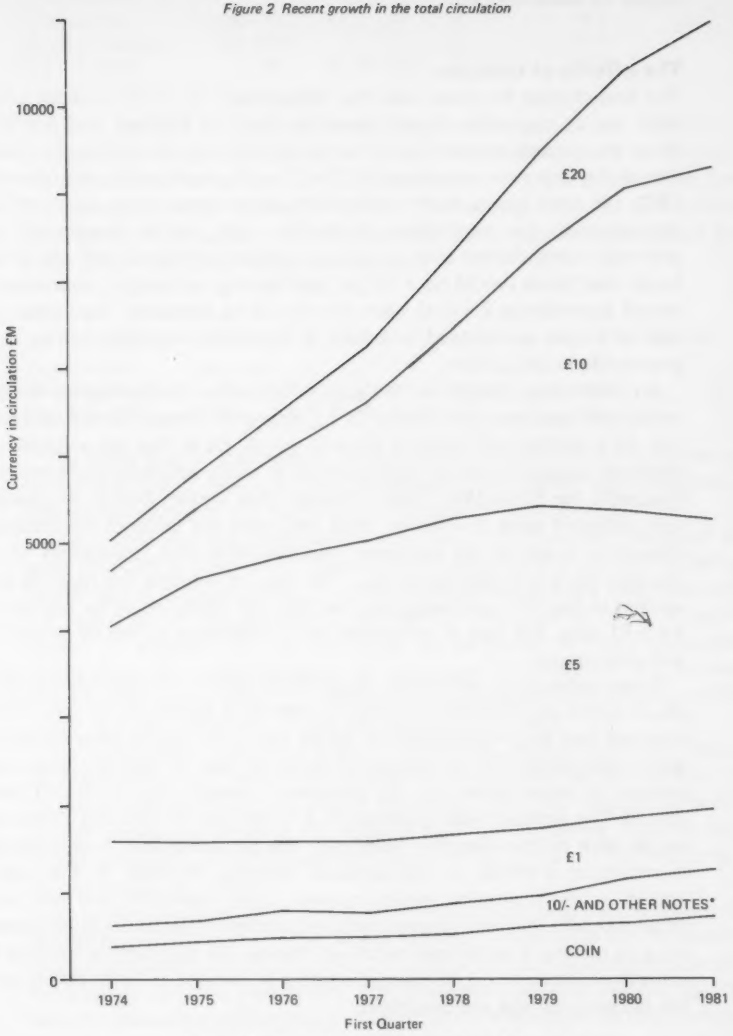
unusual in that a high proportion of wages are paid in cash, so the *Public* obtain most of their requirements from *Employers* in notes, otherwise by withdrawals from bank branches, POs, etc. The amount of coin entering circulation in this way is insufficient for the public's needs (particularly for fares and slot machines) which have to be met by the change-giving of *Retailers*. These draw coin from the Clearing Banks who receive coin from utility and transport undertakings which are in surplus. The Clearing Banks undertake considerable coin sorting by machine. The cash distribution task varies seasonally with an annual peak before Christmas. Patterns in holidays, leisure and commuting and other factors lead to a need for redistribution regionally as well.

A general principle about the structure of a currency is that it is highly desirable that the low denominations which change hands frequently should be in coin which is hard-wearing, and that higher denominations which are used less frequently should be in notes which are lighter but less durable. We can see this in the present UK currency:

COINS—PENCE	½	1	2	bronze		
	5	10		as old 1 shilling 2 shilling cupro-nickel		
	50			cupro-nickel (replaced 10 shilling note in October 1979)		
NOTES—POUNDS	1	5	10	20	50	(March 1981)

Like most currencies it is arranged in two tiers: pence and pounds. The bronze coins are related in weight by their value, as are the 5 and 10 pence, but not the 50 pence cupro-nickel pieces. The old 6d (2½ pence) was retained after decimalisation but gradually fell out of use and was demonetised in 1980. Strictly speaking, the Crown (value 25 pence) is still part of the coin issue, but is not in practical circulation. Sadly the purchasing power of the £1 today is about 27 pence by comparison with Decimalisation Day. The effects of inflation have also meant that the total value of the circulation has doubled in the last six years. In *Figure 2* it can be seen that the £10 note has now overtaken the £5 as the most significant unit in terms of value. In a similar way amongst the coinage the 50 pence has overtaken the 10 pence. Interestingly, although the £5 note's peak of significance has passed, its production is still increasing. This is due to the demand for new notes for use in cash-dispensing machines. The £1 note still accounts for the majority of the Bank of England's production. In 1979 there was evidence that the £1 note was being used in a coin role and that many of them were remaining in circulation when worn out rather than being returned to the banks as regularly as in the past. There were doubts as to whether the public would continue accepting poorer note quality. Also the Bank of England were having to plan the replacement of their printing

Figure 2 Recent growth in the total circulation



*These are high denomination notes used internally by the Bank of England. The £50 note entered circulation after the first quarter of 1981.

machinery. The possible coining of the £1 denomination was therefore a matter of some concern.

The effects of changes

The first change to assess was the replacement of the £1 note by a coin. With the co-operation of staff from the Bank of England and the Royal Mint, the consequences of continuing with the note or a phased introduction of the coin were investigated. The £1 coin would be first introduced in 1983, the note being finally withdrawn about three years later. In both organisations the alternative production and capital investment programmes were costed over a ten-year period ending in 1989–90. It was found that there would be a 10 per cent saving to central government in overall expenditure if a coin were introduced as indicated. The higher unit cost of a coin as opposed to a note is more than made up for by its far greater life in circulation.

An interesting sidelight on the appropriate value for the highest denomination coin has been provided by Dr L C Payne of Thomas De la Rue and Co Ltd. As a leading international security printer De la Rue are uniquely well placed to observe currency developments in many countries and have close links with the Royal Mint. Data obtained have shown that in 35 countries with different rates of inflation, over the years the value of the note-coin boundary tends to fall between one-twentieth and one-fiftieth of the average day's net take-home pay. This type of analysis has recently been applied to the UK*, and suggests that the mid-1980s would be appropriate for a £1 coin, but that in retrospect the introduction of the 50 pence coin was premature.

It was rather more difficult to assess the impact of the new coin at 20/25 pence which the Royal Mint wanted to introduce before the £1 coin. It was intended that this should be much lighter than most of our other coins (at 5 grams compared with the present 10 pence at over 11 grams) and so compensate to some extent for the increase in weight due to the £1 being coined. The problem was to identify the effect that introducing a new coin would have on the everyday dealings of the general public. It was decided to construct a model of the particular process involved. In this case a 'model' is not a physical replica or even experimentation and trials with different coins, it is just a mathematical statement of what the public experience by making a tender and receiving change. As an example some of the ways in which coins might change hands in a transaction for 24 pence using the present coinage are described:

*UK currency needs in the 1980s, L C Payne and H Morgan, *The Banker,* April 1981.

STYLE OF TRANSACTION	TENDER	CHANGE	NUMBER OF COINS	WEIGHT (Grams)
'Exact money'	10+10+2+2	—	4	36·9
'Minimum currency'	10+10+5	1	4	31·8
'One-unit cover'	50	10+10+5+1	5	45·3

'Exact Money' is commonplace and self-explanatory. 'Minimum Currency' is a deliberate choice of coins by the tendering party to minimise the total number of coins changing hands. 'One-Unit Cover' assumes that the tenderer chooses one denomination large enough to make up a tender to cover the transaction. The effect of a 20 pence coin being available for these same transactions is fairly obvious:

STYLE OF TRANSACTION	TENDER	CHANGE	NUMBER OF COINS	WEIGHT (Grams)
'Exact money'	20+2+2	—	3	19·3
'Minimum currency'	20+5	1	3	14·2
'One-unit cover'	50	20+5+1	4	27·7

The large gap in the present denominations between 10 and 50 pence means that the 10 pence is used excessively. A 20 pence coin produces a substantial saving in the numbers and weight of coin being handled.

The model required took shape as a computer program designed to scan through a very large number of different size transactions being carried out in different ways. The data produced were easily processed and the effect of various alternative changes to the currency could be compared. For example, as well as the 20 the 25 pence coin was examined. These new coins were assessed on their own in addition to the present coinage and with a coin at £1. More radical options like withdrawing the 50 pence and introducing a £2 coin were analysed as well.

The conclusions that were drawn in relation to transactions were that a 25 pence coin would reduce the weight of coin required by up to a third. A 20 pence offered a slightly greater reduction—this was because it had a greater impact in reducing the number of 10 pence pieces. Neither coin would completely offset the greater weight of the £1 coin; to achieve this a £2 coin would be needed.

As well as the effect of new coins on transactions it was also necessary to predict the effect on the circulation as a whole to determine the production levels at the Mint. Obviously a new 20 or 25 pence coin would make part of the existing coinage redundant. The inference was that the savings on coins in transactions would be analogous to the savings in the total circulation. This inference is supported by the similarity between the proportions of different values in current circulation and the proportions indicated by the model for the present denominations. The 20 pence coin would be

expected to allow about 20 per cent more 10 pence coins to be withdrawn than the 25 pence. However, more 20 pence coins at the same unit cost of production would be needed. Both coins in fact offer manufacturing savings by comparison with production of present coin denominations, the 25 pence offering more because fewer would have to be minted to produce an equivalent value. However, the 20 pence more than compensates by its greater displacement of 10 pence coins and their scrap value. The savings overall from introducing the 20 pence coin as opposed to the 25 pence were about 10 per cent greater.

All the savings and costs which have been discussed relate to the Exchequer. Obviously the introduction of new coins would have an effect on the operations of the bulk handlers of currency, particularly the Clearing Banks and bullion carriers. During the study the proposals were confidential to government and it was not possible to enter into discussions outside. A small amount of transport cost data were available, and by making assumptions about the size of denominations in the flows in *Fig 1,* tentative estimates of the changes to handlers were made. Although not conclusive this allowed key factors for any further investigation to be identified.

Conclusion

The study was completed in May 1980 and confirmed the Mint's belief that developments in the coinage were needed. The evidence and analyses provided contributed to briefing papers for Ministers and to the long-term production planning process at the Mint. In January 1981 the Chancellor of the Exchequer announced proposals for consultation for £1 and 20 pence coins, prior to setting precise specifications and issue dates.

On 31 July 1981 the Financial Secretary to the Treasury gave further details. The 20 pence coin would be issued for general circulation in June 1982, the £1 coin in April 1983 with the £1 note continuing to circulate so long as considered desirable. In accordance with the Coinage Act of 1971 a Royal Proclamation would in due course announce the legal status of the coins, their design and the specification for their minting.

Investment Appraisal of Computer Projects

R N Burton, Civil Service Department

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Seeking the best value for money

Most organisations have people who are currently grappling with questions about obtaining value for money in the development computer systems, either as old hands in the game or as novices entering a new world. Two contra-distinctive situations, from opposite ends of the spectrum, but not divorced from real life, illustrate the kind of dilemma confronting prospective computer users.

On the one hand, there is the situation found most commonly with private sector organisations that are seeking to set up for the first time their own computer systems. It is difficult for them to resist the temptation to jump into the 'switched on' world of computers, particularly in the face of all the talk of modern marvels which are becoming cheaper by the minute, the impression conveyed by the media that the uncomputerised equate with the illiterate, and the ingenious and sustained sales pitches generated from the supply side of a highly competitive market. Against that background there is a tendency to come to a quick decision to buy primarily on a 'let's try it and see' basis—which may not be a bad thing given the right circumstances.

On the other hand, there is the buyer who has been through it all before and has learned the hard way that it is that which is put into all the preparatory work which counts, not the act of choosing the best looking model at the showroom. Experience has taught him painful lessons about the short cuts that turn out to be culs-de-sac, the teething troubles that tend to persist into old age, the realisation that in the computer world there can be more downs than ups, and that all these are reflected in snowballing costs

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and benefits deferred. Moreover the tensions produced on the way can generate conflicts within organisations that may continue after their original causes have disappeared.

It is the past disappointments and frustrations of this kind that have contributed to the movement of the focus of decision-making away from computer people and back towards the financial authorities which has been a feature of recent internal change within many larger computer-using organisations. With this, and in the context of the more formal and continuing systems of accountability commonly found in such organisations, has come a growing concentration on detailed financial analysis which when fully developed seeks to take into account every significant aspect of costs and benefits over the life of a computer project. Thus the proposal becomes subject to a form of investment appraisal not dissimilar to that undertaken when a major capital project such as a large construction project is being contemplated. Such an approach is seen particularly in areas of public accountability; for example, the accountability to Parliament of government departments for their expenditure. Against this background, the question arises of what precisely is the relevance of such detailed analyses to obtaining the best value for money when buying a computer system. This article seeks an answer by considering, with special reference to administrative-type systems in the UK government service, the various factors that are relevant to the investment appraisal of computer and computer-based projects. In so doing it also exposes a number of basic questions concerning value for money that affect all computer users.

Computerisation of government services

The UK Government, and indeed government services in all developed countries, are spending large, and increasingly large, amounts on computer systems or, using the broader term, information technology, ie including related telecommunications and office technology developments. Currently the Government is spending at an annual rate of about £100 million on the purchase, hire and maintenance of computers. But this is only part of the cost; some 18,000 staff are employed on ADP work at an annual cost of approximately £180 million. The number of major administrative computer systems in operation exceeds 200. This represents approaching a doubling of resources devoted to computer systems over the past 10 years. During this period three further trends have become evident.

The first arises from growing public interest in the increasing outlay on computerisation coupled with concern about the lack of realisation of expected returns from some well-publicised major projects. Disappointments of the latter kind have not necessarily arisen from weaknesses in the planning and development of the projects themselves, but the fact remains that large amounts of public money have been involved and that the

expected returns have not fully materialised. This has led to questions in Parliament and to critical cross-examination of those primarily accountable before the Public Accounts Committee of the House of Commons. It has also led within government to a re-examination of the criteria used for justifying and monitoring government investment in computers. A Working Party set up by the Civil Service Department to examine this area reported in October 1979 and since that time its recommendations have been translated into guidance to be followed by government departments. The effect has been to introduce more detailed and comprehensive processes in the investment appraisal of computer systems.

The second trend has been the technological advance which has led to the spiralling downwards costs of computer hardware. The advent of the 'chip' and other technical developments, and their implications, have been well publicised in both the technical and the popular press and it is not necessary to go into the details here. But the complement to this trend has been the increasing proportionate outlay on manpower-related costs. During the period 1964 to 1978, the proportion of the average data processing budget consumed by salaries and direct overheads increased from 51 per cent to 72 per cent and the proportion consumed by hardware (processor, memory, peripherals) decreased from 38 per cent to 21 per cent.*

The third trend is a reflection of the phenomenon which has been referred to as 'convergence'. The modern development of computer systems is becoming increasingly integrated with the development of telecommunications and various forms of office technology. This at once makes the development of such systems far more pervasive and also introduces a wider set of variables. The net result is to make it even more difficult to predict what the returns will be in terms of benefits; and even where such benefits can be identified, to quantify them in a meaningful way so that they can be set against costs that can be expressed in monetary terms.

Under-analysis or over-analysis?

Therefore at the same time as the stipulated investment appraisal procedures for computers seem to be becoming more like those for major capital projects such as bridges and roads (with high fixed capital costs and a clear pattern of projected use), the subject of such procedures is changing away from its earlier 'capital-project' characteristics. Computer systems are becoming more labour intensive and covering a widening range of variable factors.

*Source: *Trends in Data Processing Costs,* May 1980, The Butler Cox Foundation.

This raises two fundamental questions. Is the expense and time devoted to such analyses worthwhile, particularly if the 'answers' produced may not be reliable? And, moreover, are they likely to increase (rather than reduce) the risk of wrong decisions being taken about project development and procurement?

If the reality is a complex of variables in which informed subjective judgement may be more important than quantitative analysis and calculations, a different approach may be required. Indeed, in the background all the time must be the consideration that the achievement of the best value for money will lie far more with the effective realisation of the project than with any analytical appraisal which precedes it however detailed the latter may be.

Why carry out investment appraisals?

The obvious primary purpose of an investment appraisal is to establish whether there is justification for spending money on a project. This justification depends on whether it can be demonstrated that the value of the benefits will exceed the costs. The benefits may result from an existing service being provided more economically, or through improvements in the service, or the introduction of a new service, or some combination of any of these elements. More fundamentally investment appraisal is about the valuation of options, including 'do nothing'.

Even though the expenditure may be justified in terms of the benefits exceeding the costs, it may still not be given the go-ahead by management. This situation can arise particularly where there is competition for resources; there may be other proposals that are also justifiable and the management problem is then to decide between them. Thus a further purpose of investment appraisal is to determine priorities as between proposed projects; in other words, some projects may be more cost-beneficial than others.

It will also be evident that such an analysis will provide the basis for a proposal to be submitted to the appropriate approving financial authority, and for the financial monitoring of a project's progress once it gets under way. In that sense particularly, the investment appraisal is an integral part of the design stage of a project.

The main elements

The obvious first task in an appraisal is to define that which is to be assessed.

Taking first the area of the project, it has to be more than the computer system itself, eg the equipment and its attendant programmers, analysts, operators, etc, as large as this area may be. It has to extend out to seek to include every change that may be made as a result of the introduction of a computer system. For very large projects it may be difficult to know which

activities to delineate for the purposes of investment appraisal. In some instances the boundaries will have to be drawn quite widely; for example, where a computer system will affect a large number of clerical operations, it will be necessary to examine the shape and size of the whole clerical organisation which will be affected as it will appear both with a computer and without a computer system. On the other hand, in a situation where the use of a computer has been established and the test now to be applied is which computer system to use (and where, say, only hardware costs and programming costs will differ), the boundaries will be much narrower.

Having established the parameters of the project, the next task is to determine its life-cycle. When dealing with normal capital projects there is an immediate tendency to think in terms of the physical life of the equipment, ie when it will be worn to such an extent that it will be more economic to replace it. But this may well differ from the economic life of the equipment which, particularly in an area of rapidly advancing technology, may become uneconomic to operate long before its physical life has come to an end.

Having settled on the parameters and the life-cycle, the third task is to assess within the framework which they provide the costs involved and the benefits to be obtained. The costs will include the contract costs with suppliers for the provision of the different types of equipment and services, accommodation, training costs, staff costs, etc. The benefits will include staff savings, accommodation reductions, improvements in speed and accuracy, etc. All these need to be separately identified and converted into monetary terms as far as possible, and their incidence recorded over the life-cycle of the project. Thus for each year or stage of the life there will be the different items recorded and as closely quantified as possible in monetary terms.

Techniques

Against the background indicated above, the most common technique employed is discounting, or to give it its full title, the Discounted Cash Flow (DCF) technique. Given the choice of having £1 this year or £1 next year, we would normally prefer even without inflation to have £1 this year. For an individual this preference might be indicated at least in part by the interest rate which he receives on money he lends, or pays on money he borrows. For the Government, which is spending money on behalf of society as a whole, satisfactory objective measures are harder to find, but there is general agreement among economists that, in comparing public expenditure over time, more weight should be given to earlier than to later costs and benefits. It is therefore misleading simply to add up the items indicated in the foregoing paragraph. They have different time-dependent values (as well as inherent values) and need to be reduced to a common base.

If the total discounted benefits over the life of the project exceed the total discounted costs, the project can be said to have a positive Net Present Value (NPV). To that extent it is considered to be financially justifiable. The NPV can also be used to rank projects in order of priority. In brief, therefore, discounting involves reducing to a present value the costs of the proposed computer system and those of the present system by the application of a discount rate.

It will be evident from the foregoing that all appraisals contain elements of uncertainty. How is one actually to deal with uncertainty when conducting an investment appraisal? One technique used by government departments is sensitivity analysis. This tests the sensitivity of the results of an appraisal to changes in its assumptions. The aim is to identify those elements which have a range of uncertainty associated with them and to calculate for each a postulated range of values rather than a single figure that may be brought into play when reaching a decision on the final authorisation of a project.

By and large the private investor is interested primarily in the profits that he will get from any investment he makes. He is concerned only with the benefits he will receive and the costs he will incur. In deciding between going ahead with a particular investment and not going ahead with it, he is unlikely to be influenced by the possibility that his action may result in costs or benefits falling on others. For example, he would not be bothered by any extra road maintenance costs that would arise through the use of any additional heavy vehicles he might need; he would be concerned only with the extra costs, eg through the extra licence fees that he would be required to pay.

However, public sector investment is made for the benefit of society as a whole. A public sector investment appraisal should, therefore, be drawn more widely than a private sector appraisal. For example, when carrying out a cost benefit analysis on, say, the need for a new London Underground line, the appraiser would be interested not only in the costs and revenues attributable to the project but the benefits to those using the new line and those who continue to use the roads but who would benefit from reduced road traffic congestion. Similarly the appraiser of a new airport might for example take account of the noise and pollution that would have to be deducted from the benefits to air travellers. It is with the techniques of these wider aspects of appraisal that cost benefit analysis is concerned.

Quantification

The pursuit of value for money in the acquisition of computer systems in the government service therefore reflects something of a restless search for introducing as much quantification as possible into the processes of investment appraisal. There is a close analysis of figures not only with regard to

the initial costs and savings relating to the computer installation itself, but about the extent and life of the whole system of which it is a part, and these calculations in turn are subjected to a battery of techniques such as discounting, risk analysis, and cost benefit analysis.

The exercise is designed to determine that 'X' in terms of government expenditure will over time produce 'Y' in terms of benefits; and the extent to which 'Y' exceeds 'X' may be taken as an indication of the order of priority for the implementation of the scheme.

This approach has solid advantages. It compels those concerned to think in advance as objectively as possible about what is involved, and it produces in detailed documentary form data supporting the justification for the project, and its order of priority. As a result, it provides a detailed basis for planning. It also erects formidable defence works in terms of public accountability, particularly in supporting a department's Accounting Officer when called upon by the House of Commons Public Accounts Committee to defend public expenditure on computer systems.

However, it is an approach which also raises a number of questions. 'If you can measure it you can manage it', runs a popular slogan. But the soundness of this concept must of course depend on the validity of the data used. If the calculation in the end produces a spurious arithmetic, or figures which fail to convey the degree of imprecision involved, the outcome can be doubly damaging not only because decisions are taken on the basis of unsound information but because the certainty conveyed by the figures themselves may create a continuing inflexibility, a reduced motivation on the part of those responsible to consider critically what they are doing and where they are going.

The subject of the appraisal

It is easy to say that the first task in an appraisal is to define the boundaries of the system. However, the process of identifying and assession every change that may be made as a result of the introduction of a computer system is fraught with difficulty. It is essential for proper investment appraisal that the boundaries should be correctly and clearly defined. The reality is, however, that there can be no precise delimitation of a major computer system; the boundaries will be blurred and the extent of the blurring will vary from place to place and from time to time.

There are even more problems associated with determining the life-cycle of a project. Some of the problems in connection with this have already been noted. The physical life of some components, eg micro-processors, can theoretically be very lengthy; the life of others, eg the electro-mechanical components, may be relatively short. But it is the economic life not the physical life of the whole system which is the main consideration. The latter is conditioned by what is in effect the life of the requirement.

Then at the end of the day there may be a disposal or redeployment value that can only be properly determined at the time and which cannot therefore be taken into account in the initial calculations.

The question of the length of the life-cycle carries with it an even deeper problem. Increasingly, as has already been noted, the value of the system is becoming less concerned with the equipment itself. A major installation comprises a complex of equipment of various kinds: software, trained staff, accommodation, maintenance services, etc. It represents a large investment in all these things over a considerable period of time. With this goes all the human attitudes of adherence to well-known procedures and processes and resistance to change. Thus, whatever the prima facie attractions of changing over to a new system, considerable arguments can frequently be marshalled in favour of prolongation of the life of the existing system.

These uncertainties about the basic features of a project, ie size and life, raise immediate questions concerning the validity of any more sophisticated analysis that might be carried out on the basis of such data.

Relevance of the techniques

Discounting is an essential element of appraisal, but unfortunately it produces further uncertainties, particularly as a change of even 1 per cent in the discount rate may have a significant effect on the outcome of the calculation. The rate used in government, ie the test discount rate or TDR is a real discount rate. Since the aim is to decouple it from contemporary movements in the value of money one would have expected this to be a constant rate, but it is in fact subject to variation. In recent years it has declined from 10 per cent to 5 per cent. A reduction, say 10 to 7, or 7 to 5, per cent TDR as has occurred in recent times can, however, have a major effect, and thereby introduce another uncertainty into the process of investment appraisal.

Risk analysis provides a way of dealing with the uncertainty of estimates used in appraisals. Risk tends to increase with the size of the project and the length of time taken to develop and to implement it, and these are often characteristics of projects in the government sector. Even if there is no reason to suspect any bias it will often be helpful to take different values of the more important and variable assumptions and work out their effects on the outcome, particularly where a project is only marginally profitable. Against the background previously discussed, however, if such an approach cannot effectively take on the major variables already noted, which could involve quite fundamental reappraisals, it does raise a question about the worthwhileness of such processes.

Some of the problems associated with cost benefit analysis are referred to later in connection with the role of government, but it is convenient here to refer to a general problem concerning the assessment of benefits. On the

costs side of an investment appraisal the various items can usually be reduced to a common monetary basis whether they relate to equipment, accommodation, manpower services of various kinds, etc. On the benefits side, however, it is not so easy. It is in fact possible to define four 'levels' of benefits according to the degree of ease with which they might be quantified: those that can be given monetary values, eg savings in posts; those that can be quantified but cannot be given a firm monetary value, eg greater accuracy; those which can be clearly identified but not quantified, eg greater job satisfaction; and those which can only be very vaguely identified, eg enhanced career development.

Thus on the benefits side it is possible to finish up with an apples and oranges situation wherein the various items cannot be reduced to a common monetary basis for comparison with the costs side.

The role of government

The wider problems involved in appraising the value of a computer system for government use have already been noted. There is not only the need to consider its value to the Government as a user of the computer system, in which case it will be concerned with the most effective use of resources for its own purposes, but the government has also to consider its responsibilities in relation to the community as a whole, in which case it needs to take into account wider social costs and benefits, theoretically at least, in their broadest sense.

There are a number of dimensions to this latter problem as illustrated by earlier examples, eg a new underground railway line or a new airport, where government has to take into account costs or benefits falling on others in addition to itself as user, and the true value as distinct from the current rent of the occupancy of property held on a long lease.

The last is an illustration of the fact that cash values may not in fact represent accurately the true value to society of costs and benefits. To ensure the proper allocation of resources, costs and benefits should be valued at prices reflecting their opportunity costs. The opportunity cost of a good or service is its highest value in uses alternative to that under consideration. Prices actually paid do not always measure opportunity costs. Where, for example, a rent is below the opportunity cost, a 'shadow price', measuring true opportunity costs, is used. Such an approach may be relevant if the Government of the day wants to take into account employment opportunities in the development of its own computer systems. It may wish to consider introducing 'shadow pricing' in such a way that the costs and benefits will need to be related to the notional employment economies or dis-economies in different regions.

This combination of the government role as user with the government role in relation to wider social and economic issues constitutes a major

complication for those with responsibilities for investment appraisal in government. On the one hand, there is the prime motivation to secure the best buy for the government as a user in the sense of maximising cost effectiveness in administration in the interests of the taxpayer. In this dimension there is a direct line of accountability from departmental officials concerned through their Accounting Officer, who is normally the Head of the department, to Parliament in the shape of accountability to the Public Accounts Committee. This system of accountability forms the framework within which the audit work of the Exchequer and Audit Department is developed. Within this dimension there is of course provision for aspects of the wider benefits to be taken into account, but the emphasis throughout is on maximising economy in administration.

On the other hand, when one comes into areas of the Government's wider responsibilities to the community as a whole, the problems of definition, let alone quantification, can become so difficult as to militate against the formulation of precise guidelines. This consequently breeds increasing areas of subjective judgement.

New office technology

Most organisations, and this is particularly true of those in the public sector, continue to spend far more on the 'traditional' computer systems than on the so-called new office technology. By the former we usually mean particularly the mainframe installations with all their attendant computer staff and, increasingly but still a relatively small proportion of the whole, the different types of mini-computer systems. In the UK government service, for example, such mainframe and mini-computer systems account for at least 90 per cent, and probably considerably more, of the total expenditure on information technology (ie computers and related telecommunications and office technology).

However, the development of micro-chip technology and its impact in terms of the increasing availability of new forms of office technology is rapidly producing another dimension to the application of technology to office type processes. This area presents something of a paradox because although it is seen as a main frontier of the so-called new technology and as having major implications for jobs and office organisation, it does not carry with it the 'big bang' changes as can be projected for the larger computer developments. It comprises primarily local small-scale developments of a pioneering nature involving no dramatic effects in terms of savings in posts. It therefore presents something of a special investment appraisal problem, for at least two main reasons.

First, in view of the fact that acquisition involves relatively small expenditures, it is more in the area of 'consumables' than capital investment. The kit can be bought off the shelf at costs way below those

characteristic of 'capital systems'. Therefore the elaborate investment appraisal procedures relevant to the larger computer projects would not appear to be appropriate for procurement of this kind.

Secondly, since the benefits are less tangible, ie the emphasis is not on savings in posts but on enhancement of standards of various types of things, eg service, accuracy, job satisfaction, etc, any quantitative approach to justification would also appear to be less relevant. Indeed, some of the benefits are so intangible as to defy the normal techniques of appraisal, though they may nevertheless be important to prospective users.

It is also implicit in the nature of the use of this equipment that there is a larger element of trialling or experimental use. In many cases, particularly in large organisations, its main purpose may be to contribute to technical expertise and knowledge of performance which cannot initially be justified in terms of any projected operating benefits.

A difficulty concerning any account of new office technology is that the whole scene is moving so rapidly that one is never quite sure what one should be aiming at. At the time of writing the above observations seem valid but they should be taken more as possible bearings given by an unreliable compass than as firm signposts. The relatively simple and small stand-alone applications of text devices (eg electronic typewriters, word processors, etc) and data processing devices (eg microcomputers) currently dominate the scene, but there is another more fundamental dimension comprising the more complex systems involving communications, eg inter-communicating office systems, local area networks, etc. The latter depend heavily on the need to experiment and will increasingly begin to absorb large amounts of investment which may eventually approach in scale that being spent on traditional computer systems. The gathering momentum of these changes will also involve the probing of accepted beliefs about office organisation, and there will be continuing related pressure to seek to define and illustrate deeper questions concerning cost justification in this field.

Thus the spreading use of different types of new office technology, which may in turn be used in communication with the more traditional computer systems, poses further questions concerning value for money in the acquisition of computer systems generally.

Staff attitudes and industrial relations

Since a major part of the cost of a system is manpower related, and this proportion is increasing, personnel considerations are clearly of importance in determining a valid appraisal. The effects on staff, eg in terms of training, increased motivation and job satisfaction, or conversely anxiety about job loss and low morale, again raise cost benefit considerations that are relevant to investment appraisal. These are given additional point by the

potential for inter-communication of all these new devices which will have a further, some say revolutionary, impact on the whole concept of office organisation and work.

The new developments have generated an increasing interest on the part of the trade unions representing the employees concerned. Their aim is to ensure that the jobs and prospects of the employees are not adversely affected and that the employees also have a share in the benefits obtained, eg in terms of higher pay, reduced hours, etc. There is also pressure to ensure that the highest health and safety standards are maintained.

The staffing dimension therefore produces further major questions for investment appraisal. First, since most of the costs and benefits are going to be related in some way to staffing considerations this must introduce more uncertainty into the calculations than if we were dealing with items of equipment.

Secondly, different categories of people are becoming involved, eg the computer staff and non-computer staff, and it must therefore be correspondingly more difficult to predict the effects in both areas. Thirdly, because of the nature of the new technology, management must become progressively more vulnerable to industrial action, eg in the form of selective strikes in order to back up demands for such things as guarantees against job loss and higher pay. The net effect is to raise more questions about the validity of forward calculations concerning benefits.

Defining the requirement

The problem of defining the requirement is one which crops up with remarkable frequency. Indeed all investigations either of specific cases or of general procedures tend to identify failure to define the requirement properly as the most common cause of subsequent difficulties. The perennial complaint of the user is that the system has been badly designed; the perennial claim of the system designer is that the user never made it clear what was wanted. This well-recognised gap is a major concern of all computer-using organisations and has been the subject of innumerable publications and directives. For example in the autumn of 1980 the Central Computer and Telecommunications Agency (CCTA) issued as guidance to all government departments a Code of Practice on this subject. Its opening sentence referred to the great disparity that 'exists between the needs of the user for whom it (the system) is designed and the specialist's perception of those needs'.

There are many factors that contribute to the difficulty of defining the requirements for a computer system. Some relate to defects in the organisational structure and control systems which are referred to in the next section. Others are concerned with the failure to comprehend the scale of change required, or the length of the gestation period, or aspects of the procurement processes. But there is a fundamental conceptual difficulty

which seems to underlie the whole thing. The user commences, even after due analysis, with a conception of his need which is primarily internally oriented. Subsequent study then increasingly relates this need to the various possible solutions that are available from the external commercial market. In this process two things tend to happen. First, the nature of the requirement as originally conceived changes, eg because a computerised approach will do something better but differently. Secondly, with further analysis the requirement breaks up into a number of mandatory and desirable features, and these can produce an apples and oranges situation for the purpose of evaluating the solution. Thus at the end of the day the solution, though immaculate from a specialist point of view, may fall considerably short of the package which the user thought that he was going to get in the first place.

The questions raised

So, for each process, technique, or approach, used in order to ensure that the government is getting value for money in the computer systems it acquires, there seems to be a question or questions arising about the reliability of the results achieved. There may be a need to carry out detailed appraisals, particularly for public accountability purposes, but is the detail worth the time and cost involved in carrying out such procedures particularly when the final sums may not be fully accurate? Is it right anyway to develop an approach appropriate to the appraisal of a capital project when in fact what we are dealing with is essentially a manpower system and one which also involves new types of variables? And to what extent is it appropriate to take into account the broader responsibilities of government in what should be fundamentally a process designed to reduce the costs of administration? Can there be, against this background, any merit in short-circuiting the analysis and buying the equipment more as an act of faith?

There are of course no simple solutions to these questions. For every doubt raised about over-analysis at least as many can be raised about under-analysis, and this tug of war produces fertile territory for the apparently unending debate about where the emphasis should be.

However, even though there appear to be more questions than answers, it is possible to identify a number of aspects that are important to any organisation seeking to improve its approach to obtaining better value for money in this field. These range from the general to the more specific, and perhaps from the more obvious to the less apparent, and they include areas where more research is needed to establish whether anyway there are any feasible answers to the questions posed. They also reflect three different dimensions or levels—organisational structure, management and personnel, procedures and processes. It is only against this broader canvas that the appraisal issue can be seen in its true perspective.

Organisational structure

The first, and fundamental, point flows from what has already been written. Investment appraisal matters cannot be weighed solely from a strictly financial viewpoint. They spread out to embrace the whole business of computer development and, because of the growing pervasiveness of such development, the organisation as a whole is increasingly involved. The real need therefore becomes not the search for some Holy Grail in the shape of a specific model investment appraisal system but how appraisal processes might best be fashioned and related to the development of a computer system in its broadest sense.

The corollary of this is that the choice of the system and its development has to be related to the user's total environment. The development of computer installations with their attendant computer people over the past two decades has typically led to their emergence as separate baronies—centres of mystery, consumers of resources, but powerful as the engine rooms that are capable of stopping the ship. It did not seem to matter so much when the computer work was only a relatively small part of the total expenditure and was being used for well-defined tasks, eg bulk processing in a self-evidently profitable way. There were few worries about leaving this to the computer people. Nowadays, when computerisation looks like spreading into all the major arteries of the organisation, there is more concern about central control. As noted at the beginning of this paper, the current trend is for these 'businesses with businesses' to become more closely integrated into the fabric of the organisation. The strategy of the whole is the framework into which the pattern of computer development must fit, not vice versa. Therefore, parallel with the increasing range of computerisation, the accountabilities are being redefined to run clearly to top management either directly or through some control mechanism such as a Computer, or Information Technology, Strategy Committee.

This process of structural change is also highlighting a special type of control question. The debate about the advantages and disadvantages of centralisation as opposed to decentralisation is as old as organisational theory itself: the different factors involved and how these apply to different types of organisations form the weft and warp of a great deal of the literature on management. The subject has been given a new twist, however, as a result of the increasing availability of cheap computing power away from the traditional computing centres. Such local developments offer large potential benefits, but at the same time pose a threat in terms of divergence from existing standards and procedures and the resultant adverse effect on the established computer systems. In this situation the first requirement is as indicated above, ie fully effective central authority, and the second requirement is the development of systems emanating from the centre

which ensure that local initiatives are developed within a unified framework of directives covering eg policy, finance, standards, etc.

Management and personnel

From the foregoing it will be apparent that the eventual success of a computer project is going to turn much more on the effectiveness of the management of its development overall than on the quality of the initial investment appraisal however deep or detailed the latter may be. The emphasis is on the management of change. The appraisal is important, but more for setting the scene than for the development of the action of the play itself. This carries the further implication that when an appraisal is being made an important balance has to be struck; the key issues in terms of costs and benefits have to be grasped firmly but not in such a way as to create a Procrustean bed which may distort the most effective development of the project itself.

An immediate rejoinder to the above argument could be that it is the initial appraisal which in turn produces the basis of the development plan and the checkpoints throughout its life-cycle against which progress at various stages can be measured. Of course this has validity—but only to a degree. No plan is immutable; what is needed is not some form of financial blueprint but a planning *system.* Such a system must above all be dynamic and progressive—one which can provide for a regular review of the initial plan, for active participation on the part of all the relevant interests, and for supporting systems to supply the data required for an effective review process and to monitor achievement. It must also function within an organisational environment that can ensure that the required changes are translated into action, eg by the adjustment of targets and the redeployment of resources to meet those targets.

More important than the structure and systems are the project people themselves, particularly the quality and continuity of leadership at the actual development levels. The best projects are those that have the best and continuing champions as well as the most effective supporting systems. Investment in the staffing and the management of the staffing of the project is the most important form of investment of all.

Procedures and processes

A greater realism and degree of flexibility might be introduced into the procedures themselves by developing a less rigidly quantitative approach. This could have a number of elements. Sensitivity analysis could be developed more systematically and comprehensively in order to cover more effectively the major aspects of the project, eg life cycle, boundaries of the project, and even discount rate levels. The analyses might be developed in such a way as to allow the scanning by a computerised system of a range of

alternative projections based on different assumptions and which could be carried forward as the project progressed. The bands of figures produced could serve as inputs to the planning system mentioned above and the whole would form a more powerful aid to management. If this could be done, any risk of the initial appraisal becoming a tablet unduly constraining the effective development of the project would be minimised, and responsibility and accountability would rest more clearly with management.

The character of any investment appraisal should be conditioned by the nature of the subject of the appraisal. Much detailed analysis may need to be applied to a new major computerised system; only primary checks should be necessary for a small replacement system. In other words, the amount of effort and resources devoted to the appraisal should reflect a sensible proportion of the overall cost of the project or its cost implications. Working from this a scheme of categorisation could be devised, eg major new systems, replacement systems, turnkey bureau systems, small systems, etc, to provide a basis for guidelines on how far and to what depth it would be reasonable to take the appraisal.

Perhaps the main distinction should be made in the case of new office technology schemes. For reasons already indicated the normal cost-benefit approach, at least in the initial stages, might simply not be appropriate. This is a rapidly-growing complex area of subtle changes, stretching out to include large numbers of non-ADP people. Investment appraisal in this area requires special study and different possibilities need to be examined. For example, in the case of replicated small systems spread over large numbers of like procurements, it might be preferable to confer a blanket 'type-approval' on such acquisitions based on a detailed appraisal of one such system. Another area that might require investigation concerns the increasing difficulty of keeping the appraisal analyses of interacting systems from interfering with one another.

Finally a basic concern needs to be about the worthwhileness of the investment appraisal procedures themselves. The time and cost involved have to be weighed against the benefits obtained. This is easier said than done, but logically there is a balance to be struck, and in the context of all the other aspects identified above the search for this balance, changing according to types of systems and other circumstances, should be a continuing preoccupation of management.

Conclusion

Against this wider background, therefore, the subject of investment appraisal in its initial analytical sense can be seen in its proper perspective. The belief that some form of snapshot at the beginning is going to portray faithfully a system throughout its life is demonstrably untenable, as is the notion that the sums done at the beginning are going to provide the blue-

print for development over many years in the face of all the unpredictable changes that will undoubtedly occur. The marginal percentage differences that figure in initial analysis and the significance then attached to them should be viewed in this light. Many of the processes have to be gone through because we must start from something and we know that so much has gone awry in the past because of lack of analysis not because of over-analysis. But the drive towards ever-more detailed investment analysis, especially involving the pursuit of quantification as the only sure and sound basis for judgement, has reached the stage when we should pause and take stock of what we are really trying to achieve. The ultimate aim is not to produce the most immaculate analysis but to develop the most effective system in value and operational terms.

From all this it seems that three main lessons emerge. First, a true appraisal should be viewed more as a progressive activity moving hand in hand with the evolution of the requirement and its solution, rather than as a tablet handed down at an initial stage containing all the commandments. Secondly, the investment appraisal process itself should be seen more as a tool which has to be as precise as its use requires rather than as a more mechanical pursuit of quantification. Thirdly, the appraisal should be developed in such a way as to contribute more effectively to the formulation and development of a dynamic planning system. At some stage of course the decision to give financial approval has to be taken, but the decision should be taken more on the basis of an assessment of this broader interpretation than on a final calculation which purports to show with precision that '£X' invested is going to produce '£Y' benefits and therefore the net gain will be '£Z'.

A Participative Assignment in IBAP

M H Grant, Civil Service Department

Malcolm Grant is a Principal in Management Development Division of the Civil Service Department. He took over leadership of the CSD team which carried out the assignment — *Editor.*

The Intervention Board for Agricultural Produce (IBAP) is headed by an Under Secretary and has been operational since 1973. It is an executive body responsible for the implementation in the UK of the Common Agriculture Policy (CAP) regulations of the EEC. Its operation is based on schemes related to particular commodities. The Board employs some 570 administrative staff, most of whom work at the headquarters at Reading. Each year the Board is involved in transactions worth some £900 million, the bulk of the funds for which come from the EEC. In the event of disallowance of a payment by the EEC auditors the Exchequer must meet the specific liability and that for similar payments, a situation which IBAP naturally seek to avoid. This paper deals with our work in the Import and Export Division (IED) of the Board which began in March 1980.

IED is responsible for applying the CAP regulations to UK imports and exports. Branch A of IED deals largely with operational policy and matters common to all areas of the Division. At the beginning of the exercise Branch B dealt with the actual processing of levy and refund claims. About 200 staff (Executive Officer to Clerical Assistant) are employed in IED mainly on the processing task assisted by a computer batch processing system using MAFF computing facilities at Guildford. The processing task is essentially 'paper driven' (half a million claims lines are processed each year) and generates a large number of documents to be sorted, transmitted, stored and retrieved.

Civil Service Department involvement

The Board had been the subject of a management review in December 1978. In their report the review team identified problems in IED which could have 'organisational, procedural and staffing solutions' and they recommended that the division should look to CSD's management services and personnel management divisions for assistance. After an approach by the Head of IED to Management Development Division (MD) it was agreed that

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a study of IED should be conducted by a team from MD who would carry out an initial survey to identify the main areas for detailed work.

The need for a team approach

A team of four practitioners was provided in order to bring together knowledge and experience encompassing the range of issues likely to be encountered, including staffing levels, staff morale and turnover, organisation, operation of a computer batch processing system, and the control of large amounts of paperwork. The team members were led by a Principal and brought experience of behavioural science; staff inspection; computer systems and new technology; and document handling, storage and retrieval.

Assignment methodology

To give the study proper direction IED set up a Steering Group (Assistant Secretary, Senior Principal and two Principals from IED, together with the Head of MD). The SG accepted that the first stage should be for the team to achieve a proper understanding of IED's work and to suggest areas for further study. IED then agreed that the team should aim to

(a) reduce error rates

(b) reduce throughput times

(c) improve arrangements for dissemination of information

(d) reduce pressure on the Principal heading Branch B (during the study IBAP management created a third Principal branch in IED and removed the Senior Principal post, enabling the processing work to be shared between branches and so reducing the pressure)

(e) strengthen representation at Brussels

(f) improve document handling and

(g) create capacity to absorb greater workload.

The SG commissioned further work in pursuit of these goals.

Participation and group working

Because of the nature of the problems to be examined and the influences and attitudes bearing on the study, it was especially desirable for the work to be conducted in as open a manner as possible with management, staff and trade unions preferably through IED's own staff. Furthermore a participative pattern of working was in keeping with the ethos of the earlier management review recommendations which had emphasised the desirability for IBAP to put its own house in order with, where necessary, the assistance of specialised outside help.

Gaining commitment

To ensure that both staff and management knew of the main study and the way it was to be conducted an Office Notice by the head of IED was circulated. The team then set about gathering further information on the work of IED through interviews and group meetings. The interviews, particularly at senior levels, were conducted against a common format. The group meetings lasted for an hour with each group comprising up to seven staff at each grade level (EO to CA).

Early in the study the team met trade union representatives to explain how the study would be conducted and to invite views and information. It was emphasised that the team would be seeking to involve IED staff as well as management in working towards the goals listed earlier.

Working group

Besides involving senior management in the study we needed to involve the staff in lower grades who were closest to the actual processing work. To achieve this a Working Group which included the Principals of each Branch and other staff chosen jointly by management and the team, down to EO level (plus the study team), was formed. Its job was

- to ensure the study proceeded on the lines intended by the SG and
- to prepare and issue Team Papers covering key aspects of the study.

The Team Papers were in effect the elements of a report on the study. And because they were prepared jointly by the study team and IED staff, they were an agreed basis for

- discussion and problem solving
- the conduct of further work or
- a recommendation to the SG on necessary action to bring about particular changes.

The open nature and general circulation of the papers (usually down to Higher Executive Officer level outside the Working Group, and to the Establishment Officer, Finance Officer and Trade Union Secretary) made them a convenient vehicle for keeping all parties informed of progress. Continuing consultation and sharing of information was reassuring to both management and staff; it also presented the opportunity for differences and misunderstandings to be identified and tackled before fixed attitudes were adopted or irrevocable decisions made.

The Working Group's first task was to prepare a Team Paper (TP1) about the study and its methodology. This paper was intended to ensure a common understanding of our purpose and working methods.

The Working Group then turned its attention to the actual clerical tasks being performed. Both management and staff needed evidence that the team fully understood the work of IED. The team studied the functions of

the various clerical tasks, the knowledge and skills they demanded, and the amount and flow of work. This led to a second Team Paper (TP2) which dealt with the clerical work of the Division and also fed back information which was by that time being gathered through interviews and group discussions. The paper was intended to ensure a common understanding of the issues under consideration. This proved especially important in establishing the basic work of the division, views of which could vary considerably between those actually doing the job and those in management positions at a distance from the actual scene of operations.

The Working Group discussed the content of TP2 and agreed the basic nature of clerical work in IED. It then commissioned work on three topics which it regarded as fundamental if IED were to work towards the agreed goals. The topics were

- Organisation
- Mechanisation
- The Burden of Paper.

Now that attention was focused on particular topics, three separate Sub-Working Groups (SWG) were set up, one for each topic. Each SWG comprised IED representatives from Principal to Clerical level plus a CSD team member with particular experience of that Sub-Group's field of study.

The SWGs each worked in a similar manner and the Burden of Paper SWG best illustrates the approach.

The Burden of Paper SWG

In setting up the SWG, divisional staff were chosen for their experience in those parts of the organisation where change was most needed (paper control areas) and where change would have the most impact (operational groups). The SWG also included a member of the Divisional Planning Unit and one of the three Divisional Principals, to demonstrate top level commitment and to enable us to test recommendations on senior management. The membership of the SWG was varied to ensure the appropriate experience was available and comprised up to twelve individuals. The COs and CAs in the division, some of whom were SWG members, had the most detailed working experience and made a valuable contribution. The group kept in touch with all the staff, on an *ad hoc* basis. To be successful the method of working had in this situation to be flexible. As the SWG got to work it became clear that the principal form in use by the division needed to be redesigned. This was a major task in itself and a separate group was set up for the purpose.

Informality was important, especially because of the wide mix of grades. At the outset team members chaired the meetings, but later this was not necessary. Formal minutes were not used, but any agreements were

recorded in working notes to ensure that debate was concrete and decisions precise. The sessions were open, lively and constructive. The main, and only noticeable, role of the team was the management of time. The main benefits of this approach were

- to increase communication and understanding, both between the team and staff, and between staff who had not worked alongside each other before
- to encourage staff co-operation and participation in the study and to reduce resistance to possible recommendations
- to foster within this forum a frank and self critical approach to systems and work management and
- to create an open and thought provoking climate for problem solving.

The right mix of staff and experience meant that from the first meeting there was lively discussion in the SWG. To avoid hasty diagnosis we went back to identifying problems by listing the burdens imposed by the paperwork. To keep an open mind we did not define what was meant by a 'burden'. No one interest was allowed to predominate in the SWG. The team concentrated at this stage on getting involvement, encouraging problems to be shared and influencing attitudes toward change rather than acting as experts with a set of ready made solutions. In this way the team was able to be continually learning and testing impressions with those of the other SWG members. The Working Group assessed working priorities and defined an overall strategy.

At this stage it was most important that everyone should understand the issues clearly and should enter into discussion about the individual 'burdens', and contribute to their resolution. The lengthy, and sometimes repetitive, discussions were well justified in bringing the SWG closer to the root of the problems that were identified. For example, apparent procedural problems sometimes derived from a weakness in the organisation of the paper flow, or from the constraints of a computer service quite outside IED. The approach also raised the strength and credibility of the team's participation and enabled staff experiences picked up earlier to be fed into debate. It became apparent that many ideas and feelings had not been fully aired before. The involvement that was generated created an agenda larger than the SWG could manageably cope with. Others were to implement the detailed proposed changes for which the SWG did not have time.

As appropriate, SWG members circulated proposed changes and discussed them with the staff. Observations and recommendations were reported back to the SWG. A great deal of enthusiasm was generated and staff eagerly co-operated with the review team.

Despite this enthusiasm, though, the goals of the staff were lower than the team, perhaps because we had time to consider more substantial

changes. Effort was needed to get them to contemplate wider options and the possibility of more radical changes. Nevertheless it was arguably better to face these difficulties as they arose than to do so all at once after a report had been delivered.

The response to the work of the SWG on paperwork was typical of other SWGs. It was not sufficient just to consult staff. They also wanted regular feedback about developments, especially when change was slow. Most interest was generated when they could see account being taken of their ideas, or when their colleagues were involved directly. Staff visited the MAFF computer centre to discuss changes and were directly exposed to the problems of ADP management. Staff identified potential simplifications and made a valuable contribution to improving their own efficiency by proposals for redesigning forms and making recommendations for changes.

The process of consultation and feedback took time and effort. Staff on the SWG also had their own work to do. However much they liked participation the extra load was not relished. This involvement of IED staff led to CSD being accused of getting its assignment on the cheap on one occasion! But there was some kudos for those who participated in the SWG and they were keen to accept the challenge. Responses clearly indicated that they would not have preferred the study to be conducted in any other way. A Principal said management and staff had never before been involved so much and he was heartened towards this approach.

After the Sub-Working Groups had been under way for two months the Review Team incorporated an Action Plan in its progress report to the SG and they agreed to the work it described. After this, more work was delegated to the other SWG members who worked increasingly under the direction of IED management. The team's influence was maintained by writing the final drafts of reports to the SG. Once the major proposals had been considered by the SG the final phase began. The team oversaw and assisted with the concluding work, but the chief motive force for change was now within IED itself.

Study of organisation

Within the civil service organisational studies have traditionally been undertaken by outsiders (often MS practitioners) conducting a study and delivering their proposals to management in report form. We adopted the participative methodology, already described, to review IED's organisation. We hoped that our experience of organisation coupled with IED staff's detailed knowledge of the Division's work would combine to produce proposals best suited to IBAP's needs.

The SWG on organisation comprised IED staff at all grades from EO to Principal plus one of the CSD Team. Their first task was to consider the

three options for IED organisation set out in the earlier report by the management review. The options were that IED should be

(a) grouped by commodity

(b) grouped by trader or

(c) grouped in their existing form with responsibility for interpretation of CAP Regulations and development of policy separated from processing operations.

The Group's role was to ensure that each option was fully considered and arguments for and against properly developed. The work of examining the options was a stormy period for the SWG and the team members with them. The paper that was produced by the SWG was presented to the SG as an appendix to the team's study report at the end of July 1980. The SG accepted the SWG paper wich set out a reasoned case for rejecting options *(a)* and *(b)* and for doing further work to develop alternative organisations within the overall concept of option *(c)*.

While working on the paper for the SG, the SWG was able to demonstrate the importance of some neglected functions to management and staff. These included key areas such as planning, control, and timely dissemination of statistics of commodity/trader breakdown and of other information. The SWG, in considering option *(c)* in greater detail, were able to include these functions in their list of needs to be met by organisational change.

The SWG then worked smoothly to prepare a further paper making proposals to rationalise the work by separating operational work more clearly from the EEC regulations and service tasks of the Division. Further study had confirmed that the operational work of IED was essentially organised on a commodity basis for its operational work, but that the grouping of responsibility for commodities and the high number of single commodity traders meant that 80 per cent of traders were treated as if the organisation was trader based. This led the SWG to examine the possible advantages of introducing further changes to deal with the remaining 20 per cent of traders. A more detailed study of these possibilities was put in train by IED management.

It is too early to know whether this participative approach to an organisational study has been totally successful. However, the recommendations made by the SWG can be tested against the goals and we can use experience of other studies to comment on some of the results. Management and staff are agreed that most of the goals have been met and are expecting further improvements in the light of working experience of the implemented proposals.

When comparing this organisational study with others there are three points of note: no radical organisational changes were proposed; but

management and staff exhibit a high level of commitment to the agreed changes, and proposals have been implemented more completely and quickly than is often the case.

Lessons learned

As a team we have learned a number of lessons from the study of IBAP

Participation has paid off. Changes were made without the production of a formal report; it made the implementation process part of the study, with senior management accepting responsibility for introducing and monitoring changes; it has made a more economic use of the time of CSD specialists.

Evaluation criteria need to be agreed jointly with the client early in a study

- to allow early progress to be demonstrated and to dispel doubts over methodology
- to enable objective judgements to be made on the success of the study
- to assist senior management in deciding what they want from the study and
- to give assignment staff criteria for measuring the effectiveness of their efforts.

Visible management commitment to the study is necessary to persuade staff that changes will take place.

Processes for bringing about change are the most important contribution from assignment staff. Their experience and specialist knowledge of such processes are essential ingredients, backed by fact-finding and analysis techniques.

Trade unions are an important element in introducing change successfully. Once again we had confirmation that to enable them to exercise their role fully they need to be directly involved from the start of a study.

The report of a study should be aimed at assisting change to take place. Ideally, particular changes should be agreed prior to writing and the report should typically contain

- a situation report
- procedures for introducing further changes
- an action plan and
- opportunities for management to reaffirm its commitment to implementing changes.

Flexibility of approach must be evident to ensure that information is objectively assimilated and situations reacted to in a positive manner likely to result in a successful study.

Team building is necessary to provide pace to an exercise and to ensure that members all understand the purpose of the study and how the team hopes to proceed.

Management Bookshelf

Reading about Operational Research

R C Riddett, Civil Service Department

This article is designed to provide for the lay reader some general guidance on the structure of OR literature and to offer a few specific suggestions for those determined to venture further. It is not aimed at the Operational Research practitioner who will already have his own well-formed prejudices about what is of value and what is not on the bookshelves.

To counterpoint the structure of the literature, or in some cases the lack of it, a brief comment on the nature and history of OR is useful. The procedure that has, since early in the 1940s, been labelled OR is nothing new. It was probably in use when the pyramids were built. With the naming of the subject, however, came notions about its underlying philosophy and methodology which have exercised OR practitioners ever since.

More recently the advent of the computer as a processing tool has extended the horizons of OR and in particular has vastly increased the detail and complexity which can be encompassed in models, which are the core of OR methodology. The computer environment may also have been instrumental in moving the emphasis of OR from problem orientation to system orientation over the last 20 years.

It should not be surprising therefore that we can find all of these threads of thought encapsulated in the literature from the descriptive historical treatments of those involved during the Second World War generally presented with hindsight to basic text books, both technique and core oriented, and via specialist books dealing in depth with particular methods or problem areas to the more philosophical books which try to say what OR is, and how one does it. This latter area is, in the view of many practitioners, still short of a really definitive contribution if indeed one is possible.

A good starting point for the lay reader is *A Manager's Guide to Operational Research* (Wiley; 1963). This book is short, being little over 100 pages long, and contains no mathematics to speak of. It does cover the major aspects of OR and its historical background and presents a short but important list of references up to the early 1960s. The authors, Patrick Rivett and Russell Ackoff, have long experience in the practice and teaching of OR and make interesting reading. For those who enjoy a little simple arithmetic a later book by Patrick Rivett, *Concepts of Operational*

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Research (Watts; 1968), covers much the same ground but with numerical examples. It is now out of print but your library may have it.

Where one goes from simple beginnings is very much a matter of choice and these two books will open up many possibilities. To get the flavour of the past I would suggest *OR in World War Two* by C H Waddington (Elek Science; 1973). This book deals with the part operational research played in the war against U-boats and gives a good account of the approach to problems at that time. It also introduces many of the key figures in the early development of OR. For a more intimate picture of the early OR scientist one can do no better, I think, than read Sir Bernard Lovell's *Biographical Memoir of P M S Blackett* (Royal Society; 1976). This book puts into the context of an eminent career in science the time which Pat Blackett spent developing OR methods during the Second World War.

Of course past history may not be your thing at all. If you are more interested in what OR is like now and in rather more detail than the Rivett book offers I recommend *Introduction to Operations Research* by Churchman, Ackoff and Arnoff (Wiley; 1965). Though rather dated now, this volume still covers the major applications adequately. In particular it makes an interesting early attempt to define the OR process from problem formulation through to construction and solution of models. To clear up any confusion perhaps one should explain here that Operations Research and Operational Research are synonymous, the former being the American title.

As an alternative to the American work, the reader might try *Operational Research in Management* by Eddison, Pennycuick and Rivett (English Universities Press; 1962). This book, again from the early 1960s, deals in somewhat less detail with the major 'techniques' of OR and also includes chapters on measurement, data handling, human aspects of problems, and control systems. It has, in my view, the advantage that chapters are contributed by a wide range of specialists thus introducing some variety into the treatment as well as the content. This book also is out of print but you may find a library with a copy.

Perhaps the most comprehensive and open-ended of works in the OR literature is the series *Progress in Operations Research* of which three volumes have been published to date by Wiley. I would recommend this series more for reference than for casual reading but it is well worth looking at if one is interested in how techniques have developed in recent years. Volume 1 was edited by Ackoff (1961), volume 2 by Hertz and Eddison (1964) and volume 3 by Aronofsky (1969).

Many OR books are produced with teaching in mind and carry both worked and unworked examples. I do not pretend to be familiar with more than a few of these books but I will recommend, by virtue of personal experience, *Operations Research* by Sasieni, Yaspan and Friedman (Wiley;

1959). If a more recent offering is needed I suggest *Operational Research for Management* by Littlechild (P Allen; 1977). This book contains a section on problem formulation which, though not definitive, does introduce some of the issues which make the art of problem formulation so hard to define.

For the most part the works so far mentioned rely on model problems to demonstrate methods; for case studies the reader should consult volumes in the series *Proceedings of International Conferences on Operational Research** and issues of the monthly *Journal of the Operational Research Society* (Pergamon Press). Both of these sources contain many theoretical papers, and some of the practical studies may be denuded of data for various reasons, but enough detail remains to give an appreciation of the main features of problems and their solutions. In my experience, however, a great deal of rationalisation tends to accompany the process of writing papers retrospectively and the reader should be aware that many of the minor difficulties may have been underplayed particularly in the more diffuse of problems.

So far I have confined my suggested reading to books and journals which give a general view of OR albeit slanted perhaps towards its history, its application or its teaching. There are of course many specialist books in the OR field and to provide a framework against which to mention some of them the chapter on form and content of problems in *A Manager's Guide to Operational Research* is a good starting point. From this chapter it will be clear that certain types of problem and certain techniques for dealing with well defined problems can be described. The suggestions I make here for reading are in addition to those offered by Rivett and Ackoff, in part due to passage of time but also to take in some interesting books on the fringe of the subject.

Over the last 20 years the major developments in stock control, or inventory control as it is termed in the American literature, have been in the increasing use of computers and in two specific by-products of the computer application. The first is the increasing emphasis on the importance of the forecasts of demand, supply and lead time in effective stock control. Two books at the extreme ends of the forecasting spectrum are worth being aware of at least. *Statistical Forecasting for Inventory Control* by R G Brown (McGraw-Hill; 1959) is one of the earliest works to introduce weighted moving averages in the context of stock control. Quite recently *Time Series Analysis* by Box and Jenkins (Holden Day; 2nd edition 1976) has provided perhaps the definitive work on this subject, though be warned that it is a very mathematical treatment. The second development is simulation which I will deal with later.

**Operational Research—proceedings of the international conference.* 5th conference (1969) J Lawrence (editor): Tavistock 1969/6th conference (1972) M Ross (editor): North Holland 1973.

Although advances in the range and treatment of allocation problems have been made over the last 20 years, particularly under the influence of increasing computer power and versatility, the basic principles have not changed. A short work on the subject which I recommend is *Readings in Mathematical Programming* by S Vajda (Pitman 1958 and as *Readings in LP* second edition 1962). This work deals directly with a number of real problems in simplified form and does not make mathematical demands on the reader.

A comprehensive work on the subject is *Linear Programming and its Extensions* by G B Dantzig (Princeton UP; 1963) though this is more appropriate to the practitioner than the lay reader. Before leaving this subject one should point out that in this context 'programming' is a term describing the sequential process of computation and does not imply computer programming (though the computer is usually needed). So do not look for these works under the heading of computer programming.

Queuing Theory developed from work done in the 1920s by Erlang and as such the theory is now well understood. It has been increasingly recognised, however, that in all but the more simple or restrictive applications the theory is impracticable. Recently, again under the influence of computers, a procedure known as simulation has been successfully used to solve queuing and stock control problems (and other problems also). I would suggest two books on the subject. *The Art of Simulation* by Tocher (EUP; 1963) is a specialist work which deals with the 'nuts and bolts' of the process and is illustrated with a number of case studies. *Simulation in Business and Economics* by Meier, Newell and Pouzer (Prentice Hall Inc; 1969) is a more general book giving a broad picture of what can be done by simulation and how. It discusses special computer programs designed to facilitate computer simulation and also covers Industrial Dynamics, a particular form of simulation based on differential equations.

The last area covered by Rivett and Ackoff which I would add to is that which they call competition. A theory of competition called 'game theory' was developed in the 1930s and described in a book called *Theory of Games and Economic Behaviour* by Von Newmann and Morgenstern. This book is something of a *tour de force,* however, and I advise the lay reader to leave it on the shelf. A light-hearted treatment of the subject by Williams entitled *The Complete Strategist* (McGraw-Hill; 1966) is well worth reading and will not be too mathematical for the lay reader. Another work of a more philosophical form which I recommend is *Fights, Games and Debates* by Rapoport (University of Michigan Press; 1960). This book discusses the role of game theory at national and international levels. The development of the use of games in solving management problems is one of the most active research areas in OR at present so if you are interested in recent work consult recent issues of the *Journal of the Operational Research Society.*

Other applications and techniques have been identified since the Rivett and Ackoff book was first published and of these the principal one concerns Dynamic Programming. The major work on this subject is *Dynamic Programming and Modern Control Theory* by R E Bellman and R E Kalaba but a more readily digestible volume is *Applied Dynamic Programming* by Bellman and Dreyfus (Princeton UP; 1962). The method usually involves a recursion relationship based on the principle of optimality developed by Bellman. For the special recursion relationship known as Markov Process, R Howard has written a very compact book called *Dynamic Programming and Markov Processes* which is worth reading if one has an interest in Dynamic Programming in particular and a grasp of matrix algebra generally.

Finally, and because views on what constitutes OR vary widely, the reader should not be surprised to find books without OR in the title which look very much like OR books and subjects which are under the heading of OR which seem on the face of it to be rather broader in their content. I would suggest that in the context of the latter *Decision and Control: the meaning of operational research and management cybernetics* by Stafford Beer (Wiley; 1966) is worth reading. It is strictly a book about cybernetics and will give the reader ample scope for speculation about the extent to which the subjects overlap.

You will have noted by now that much of text book or technique-based OR seems to be about optimisation and as a contrast you might like to read one of the recent books on catastrophe theory, say *Catastrophe Theory* by Woodcock and Davis (Dutton; 1978). There is more than just a hint in the concept of catastrophe theory that optimisation is not a good thing! But then if you compare OR case studies with text books you may conclude that not a lot of optimisation is either sought or achieved in practice.

My own prejudices and exposure to the literature have clearly influenced the choice of works recommended, this is demonstrated by the publication dates of the bulk of the works. This does not imply that there are no up-to-the-minute works to suit the lay reader, though in truth I know of nothing so appropriate as *A Manager's Guide to Operational Research.* For the most recent works I would recommend any potential reader to scan the book reviews in recent editions of the *Journal of the Operational Research Society.*

Computer Installations for Government Departments

A list of all Government computers as at 1 January 1981 was published as a supplement to the May 1981 edition. Details of computers ordered during the period 1 April to 30 June 1981 are shown in the following table.

Date of Order	Department[1]	Location	Main Uses	Manufacturer[2] and Type of Computer
1B Computers on order for administrative and general purposes				
April 1981	Defence (Central)	Hullavington	ISIS project	DG 8622-RA4 C/150 minicomputer
May 1981	National Library of Scotland	Edinburgh	Library information system	HP 3000 Series 44
June 1981	DHSS	London	Operational research	Prime 250-II
June 1981	Defence (Central)	Hullavington	ISIS project	Scandata 2250/1
June 1981	Defence (Army)	Woolwich	Administration and diagnostic index	DEC PDP 11/44
June 1981	Inland Revenue	Leeds	Taxation of Lloyds underwriters	Prime 750
June 1981	Inland Revenue	London	Taxation of Lloyds underwriters	Prime 400
June 1981	Defence (Navy)	Chatham	Planning and control systems	Prime 750
2B Computers on order for scientific and technical purposes				
April 1981	Defence (Navy)	Dunfermline	Static-dynamic structural analyses	DEC VAX 11/780
May 1981	Industry	Teddington	On-line analysis for aero and hydro-dynamic facilities	Prosig PDPTT system (×2)
May 1981	Defence (PE)	Farnborough	Assessment of avionics	Prime 750
May 1981	Defence (Air)	Cardington	Weather forecasting and data logging	DEC PDP 11/34AX (×2)
June 1981	Defence (PE)	Malvern	Information retrieval	DEC PDP 11/34
June 1981	Defence (Central)	London	Civilian management training	DEC PDP 11/34A

[1, 2] Refer to supplement to May edition for Department and Manufacturer keys. Abbreviations for the following manufacturers are included for the first time: Prosig—Prosig Computer Consultants; Scandata—OCR Scandata.

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